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ABSTRACT

This package contains both an instructor's manual and student materials for a course in appliance repair. The instructor's manual is designed to aid the instructor in the use of the Kentucky Appliance Repairer Competency Based Task Assignment System. Following a description of the field and a list of 77 references, the instructor's manual is organized by task assignment sheets. Each task assignment sheet is made up of a learning activities sheet, student self-check, instruction sheets, instructor's final checklist, and instructor's guide sheets (with information on learning activities, references, and videotapes). Each task assignment sheet contains the following elements: (1) the condition under which the student will perform the task objective; (2) the performance required of the student on that task after instruction; and (3) job-related standards for measuring the successful performance of the objective. The instructor's manual also contains background information and suggestions for occupations for early leavers. The student package contains task assignment sheets that consist of an introduction, objective, check-out activity (procedural steps), learning activities, student self-check, instructions, and instructor's final checklist. (KC)

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Instructor's Manual

APPLIANCE REPAIRER

Competency - Based Education

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Instructor's Manual

APPLIANCE REPAIRER

D.O.T.
637.261-018, 723.381-010
827.261-010

Competency-Based Vocational Education

Office of Vocational Education
Kentucky State Department of Education
Alice MacDonald, Superintendent

Office of Training Services
College of Industry and Technology
Murray State University

1986-87

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INTRODUCTION

This instructor's manual is designed to aid the instructor in the use of the Appliance Repairer Competency Based Task Assignment System. The program was designed to develop the competencies needed by an appliance repair technician.

Instructor guide sheets for each task assignment give information for each learning activity, reference and page numbers, video presentations and check-out activities. The instructor should review the instructor guide sheets to determine needed texts, materials, and supplies. Requests may be made for manufacturer's publications, many of which are available free of charge.

The recommended reference and audio-visual materials are incorporated in the student task assignment sheets. Space has been allowed for the instructor to add or substitute listings according to material availability.

Teachers are encouraged to identify subject areas which need additional tasks assignment sheets and to develop materials to fill those needs.

ORGANIZATION OF THE MANUAL

This instructor's manual is organized by task assignment sheets (TAS). Each Task Assignment Sheet is made up of a Learning Activities Sheet, Student Self-Check, Instruction Sheets, Instructor's Final Checklist, and Instructor's Guide Sheets. These materials were prepared from job-related task statements from the occupational inventory survey conducted by the Office of Training Services, Murray State University.

Each TAS contains the following elements: (1) the condition under which the student will perform the task objective, (2) the performance required of the student on that task after instruction has taken place, and (3) job related standards for measuring the successful performance of the objective. The learning activities for each TAS has been suggested after a thorough review of the materials available for each task. Listing of a reference in no way infers that this is the only appropriate source and is not to be taken as a blanket recommendation of the publication. There may be other valid sources in addition to the one cited and space has been provided to list additional references.

The task objectives (criterion-referenced measures) are items designed to test student achievement of the task assignments. They are test situations which instruct the student to perform a certain action.

The check-out activities are procedural steps and subordinate to task performance. The instructor's final checklist provides more specific itemization of procedural steps. They may require slight modification due to availability of tools, equipment differences, local practice, etc. Only one check-out method is given per task, although several alternative ways to perform the evaluation may be available to the instructor.

DESCRIPTION OF OCCUPATIONAL FIELD

The primary purpose of this section is to provide a general orientation to the occupational field. This orientation may be used by counseling and guidance staff in helping student to select areas. It may be also used by instructors for new students just entering the program area. The description delimits the scope of the occupational field in terms of the range of activities involved in a series of occupations. It contains information about career potential within the occupational field, including job market conditions and trends.

The description identified prerequisite skills and knowledge for those students interested in entering the occupational field. In addition, the Description of Occupational Exit Points are provided to aid the instructor in identifying possible jobs for early leavers. A listing of employability skills is also included in this section.

Appliance Repairers

Nature of the Work

In the past, most household chores such as cooking and cleaning were performed by hand and often involved a great deal of time and physical effort. Today, a variety of laborsaving appliances make many household jobs much simpler to do. Microwave ovens cook meals in minutes. Washers and dryers clean clothes with little physical effort. Indeed, the number of household jobs machines can do is almost limitless. Even simple tasks such as cooking a hamburger or opening a can are done with appliances made specifically for those purposes. Servicing these machines is the job of the appliance repairer.

Appliance repairers usually specialize in servicing either portable appliances such as toasters and irons or major appliances such as refrigerators and ranges. In large repair shops, they may specialize in particular items such as clothes washers and dryers or refrigerators and freezers.

Portable appliances are worked on in shops. Major appliances usually are repaired in customers' homes by appliance repairers who carry their tools and a number of commonly used parts with them in a truck.

To determine why an appliance is not working properly, repairers operate it to detect unusual noises, overheating, or excessive vibration. They look for common sources of trouble, such as faulty electrical connections, and consult service manuals and troubleshooting guides. They may disassemble the appliance to examine its parts. To check electric systems, repairers follow wiring diagrams and use testing devices, such as ammeters, voltmeters, and ohmmeters.

After locating the trouble, the repairer makes the necessary repairs or replacements according to the type of appliance and defect involved. To fix a portable appliance such as a toaster, the repairer may replace a defective heating element. To fix a major appliance such as a washer, the repairer may replace worn bearings, transmission belts, or gears. To remove old parts and install new ones, repairers use common handtools, including screwdrivers, soldering irons, files, and pliers, and special tools designed for particular appliances. Repairers operate the appliance after completing a repair to check their work.

Repairers may answer customers' questions and complaints about appliances and frequently advise customers about the care and use of the appliance. For example, they may show the owner how to load automatic washing machines or arrange dishes in dishwashers.

Appliance repairers may estimate and collect the cost of repairs. They also keep records of parts used and hours worked on each job.

Working Conditions

Repair shops generally are quiet, well lighted, and adequately ventilated. Working conditions outside the shop vary. For example, repairers sometimes work in narrow spaces and uncomfortable positions amidst dirt and dust. Those who repair appliances in homes may spend several hours a day driving, although the use of 2-way radios has decreased this time.

Although the work generally is safe, repairers could have an accident while handling electrical parts and lifting and moving large appliances. Inexperienced workers are shown how to use tools safely and how to avoid electric shock.

Appliance repairers usually work with little or no direct supervision. This feature of the job appeals to many people.

Places of Employment

About 145,000 people were employed as appliance repairers in 1986, mostly in independent appliance stores and repair shops. Others worked for service centers operated by appliance manufacturers, department stores, wholesalers, and gas and electric utility companies.

Appliance repairers are employed in almost every community, but are concentrated in the more highly populated States and metropolitan areas.

Training, Other Qualifications, and Advancement

Formal training in appliance repair and related subjects is available from some high schools, private vocational schools, and community colleges. The programs in these schools provide the background in electrical and mechanical repair that is needed to enter this occupation. However, graduates usually receive additional training from their employer.

The type of training provided by employers varies among companies. In shops that fix portable appliances, new employees work on a single type of appliance, such as vacuum cleaners, until they master its repair. Trainees then move on to work on a different type of appliance; this process continues until they can repair a variety of appliances. In companies that repair major appliances, beginners may be trained by experienced repairers during house calls. In other cases, they are taught while working in the shop rebuilding used parts such as washing machine transmissions. Up to 3 years of on-the-job training may be needed to become skilled in all aspects of repairing some of the more complex appliances.

Some large companies such as appliance manufacturers and department store chains have formal training programs, which include home study courses and shop classes, where trainees work with demonstration appliances and other training equipment.

Many repairers receive supplemental instruction through seminars that are conducted periodically by appliance manufacturers. These seminars usually last 1 or 2 weeks and deal with the repair of one of the manufacturer's appliances. To become familiar with new appliances and the proper ways to repair them, experienced repairers attend training classes or study service manuals.

Persons who want to become appliance repairers generally must have a high school diploma. Courses in electricity are essential because most repairs involve work with electrical equipment. Mechanical aptitude is also desirable. Appliance repairers who work in customers' homes must be able to get along with people.

Appliance repairers in large shops or service centers may be promoted to supervisor, assistant service manager, or service manager. A few may advance to managerial positions such as regional service manager or parts manager for appliance manufacturers. Preference is given to those who show ability to get along with coworkers and customers. Experienced repairers who have sufficient funds may open their own appliance stores or repair shops.

Employment Outlook

Employment of appliance repairers is expected to grow about as fast as the average for all occupations through the 1980's. In addition to the jobs created by growth of this occupation, many openings will arise each year from the need to replace experienced repairers who retire, die or transfer to other occupations.

The number of appliances in use is expected to increase very rapidly as the number of households grow and new and improved appliances are introduced. Maintaining this large number of appliances will increase the need for qualified repairers.

People who enter the occupation should have steady work because the appliance repair business is not very sensitive to changes in economic conditions

Earnings

Hourly earning of appliance repairers ranged from $5 to $10 in 1986, based on the limited data available. The starting rate for inexperienced trainees was about $3.75 an hour. The wide variations in wages reflect differences in repairers' skill and experience, geographic location, and the type of equipment serviced.

Some appliance repairers belong to the International Brotherhood of Electrical Workers.

Related Occupations

Other workers who service electrical and electronic equipment include air-conditioning mechanics, bowling-pin-machine mechanics, business machine repairers, electric sign repairers, electronic organ technicians, television and radio repairers, and vending machine mechanics.

Source of Additional Information

For further information about jobs in the appliance service field, contact local appliance repair shops, appliance dealers and utility companies, or the local office of the State employment service.

Information about training programs or work opportunities also is available from:

Association of Home Appliance Manufacturers
20 N. Wacker Dr., Chicago, Il 60606

DESCRIPTION OF OCCUPATIONAL EXIT POINTS

637.261-018 Gas-Appliance Servicer:

Installs and repairs gasmeters, regulators, ranges, heaters, and refrigerators in customer's establishment, using manometer, voltmeter handtools, and pipe-threading tools: Measures, cuts, and threads pipe and connects it to feeder line and equipment or appliance, using rule, pipe cutter, threader, and wrench. Tests and examines pipeline and equipment to locate leaks and faulty pipe connections and to determine pressure and flow of gas, using manometer, voltmeter, combustible gas indicator, and soap lather. Dismantles meters and regulators and replaces defective pipes, thermocouples, thermostats, valves, and indicator spindles, using handtools. May assemble new or reconditioned appliances. May collect for monthly bills or overdue payments. May be designated according to appliance serviced as GAS-REFRIGERATOR SERVICER (any ind.); GAS-STOVE SERVICER (any ind.).

637.684-010 Gas-Appliance Service Helper:

Assist GAS-APPLIANCE SERVICER (any ind.) in installing, testing, adjusting, and repairing regulators, ranges, and heaters, in customers establishments: Transports tools, parts, equipment, and appliances from truck to customer's establishment, using handtruck. Measures, cuts, threads, and connects pipe to feeder line and installes appliances, using pipe cutter, threader, and wrench. Dismantles appliances and replaces defective pipes, thermocouples, thermostats, valves, and spindles, using handtools. Performs other duties as described under HELPER (any ind.). May be designated according to kind of appliance repaired as GAS-STOVE-SERVICER HELPER (any ind.).

723.381-010 Electrical-Appliance Repairer:

Appliance-service representative; small-appliance repairer. Repairs electrical appliances, such as toasters, cookers, percolators, lamps and irons using handtools and electrical testing instruments. Examines appliance for mechanical defects and disassembles appliance. Tests wiring for broken or short circuits, using voltmeters, ohmmeters, and other circuit testers. Replaces defective wiring and parts, such as heater elements and percolator coils, using handtools, soldering iron and spot-welding equipment. May compute charges for labor and materials. May assist ELECTRICAL-APPLIANCE SERVICER (any ind.) in repairing such appliances as refrigerators and stoves.

723.584-010 Appliance Repairer:

Repairs portable, household electrical appliances, such as fans, heaters, vacuum cleaners, toasters, and flatirons, on assembly line. Refers to inspector's checklist, or defect-symbol marked on appliance, to identify defective or malfunctioning part. Disassembles appliances to remove defective part, using power screwdrivers, soldering iron, and handtools. Installs new part, and reassembles appliance. Records nature of repair in log or on mechanical counting device. Maintains stock of replacement parts. May determine repair requirements by connecting appliance to power source or examining parts for defects while disassembling. May file or bend parts to remove burrs, or to improve alignment and fit. May hold appliance against buffing or polishing wheel to remove scratches from metal surfaces. May touch up paint defects, using brush or spray gun. May be designated according to part repaired as HEATING-ELEMENT REPAIRER (elec. equip.); or appliance repaired as ELECTRIC-FRYING-PAN REPAIRER (elec. equip.); FOOD-MIXER REPAIRER (elec. equip.); VACUUM-CLEANER REPAIRER (elec. equip).

827.261-010 Electrical-Appliance Servicer:

Installs, services, and repairs stoves, refrigerators, dishwashing machines, and other electrical household or commerical appliances using handtools, test equipment, and following wiring diagrams and manufacturer's specifications: Connects appliance to power source and test meters, such as wattmeter, ammeter, or voltmeter. Observes readings on meters and graphic recorders. Examines appliance during operating cycle to detect excess vibration, overheating, fluid leaks, and loose parts. Disassembles appliance and examines mechanical and electrical parts. Traces electrical circuits, following diagram, and locates shorts and grounds, using ohmmeter. Calibrates timers, thermostats, and adjusts contact points. Cleans and washes parts, using wire brush, buffers, and solvent, to remove carbon, grease, and dust. Replaces worn or defective parts, such as switches, pumps, bearings, transmissions, belts, gears, blowers, and defective wiring. Repairs and adjusts appliance motors. Reassembles appliance, adjusts pulleys, and lubricates moving parts, using handtools and lubricating equipment. May be known according to appliance repaired as CLOTHES-DRYER REPAIRER (any ind.); COFFEE-MAKER SERVICER (any ind.); DISHWASHING-MACHINE REPAIRER (any ind.); ELECTRIC-RANGE SERVICER (any ind.); WASHING-MACHINE SERVICER (any ind.).

TASK ASSIGNMENT SHEET MASTER LIST

APR-001	Demonstrate Knowledge Of Safety Practices.
APR-002	Check Electricity.
APR-003	Identify Properties Of D.C. Electrical Circuits.
APR-004	Define Electrical Quantities.
APR-005	Use A VOM To Measure Electrical Quantities.
APR-006	Measure Resistance.
APR-007	Measure Voltage.
APR-008	Measure Current.
APR-009	Apply Basic Electrical Theory.
APR-010	Work With Electrical Components, Symbols, and Diagrams.
APR-011	Check for Magnetism and Electromagnetism.
APR-012	Work With Series Circuits.
APR-013	Work With Parallel Circuits.
APR-014	Work With Combination Circuits.
APR-015	Work With Relays and Solenoids.
APR-016	Check Characteristics Of Alternating Current.
APR-017	Check Capacitors.
APR-018	Splice Wires.
APR-019	Work With Single-Phase A.C. Induction Motors.
APR-020	Replace Digital Component.
APR-021	Use Soft Solder To Join Metal Fittings.
APR-022	Appliance Cabinets.
APR-023	Adjust Doors On Refrigerators And Freezers.
APR-024	Install Icemaker In Refrigerator.

APR-025	Repair Flex Tray Icemaker.
APR-026	Replace Refrigerator Defroster Heating Element.
APR-027	Service Electric Motors.
APR-028	Install Electric Range.
APR-029	Replace Electric Range Surface Heating Element.
APR-030	Replace Electric Range Oven Heating Element.
APR-031	Replace Electric Range Ballast Transformer.
APR-032	Replace Electric Range Clock/Timer.
APR-033	Replace Electric Range Oven Thermostat.
APR-034	Install Garbage Disposal Unit.
APR-035	Install Electric Clothes Dryer.
APR-036	Read Wiring Diagrams For Clothes Dryers.
APR-037	Replace Electric Dryer Service Cord.
APR-038	Replace Electric Dryer Heating Element.
APR-039	Replace Electric Dryer Temperature Control.
APR-040	Replace Electric Dryer Drive Belt.
APR-041	Replace Electric Clothes Dryer Motor Capacitor.
APR-042	Replace An Electric Dryer Blower Assembly.
APR-043	Troubleshoot An Electric Dryer.
APR-044	Install An Automatic Washer.
APR-045	Replace Automatic Washer Drive Belt.
APR-046	Replace Automatic Washer Injector Nozzle.
APR-047	Replace Automatic Washer Transmission.
APR-048	Replace Automatic Washer Temperature Switch.
APR-049	Replace Automatic Washer Timer.
APR-050	Replace Automatic Washer Pressure Switch.
APR-051	Replace Automatic Washer Drain Pump.
APR-052	Replace An Automatic Washer Electric Motor.

APR-053	Install An Electric Water Heater.
APR-054	Replace Electric Water Heater Heating Element.
APR-055	Replace Defective Wiring On A Water Heater.
APR-056	Replace Electric Water Heater Thermostat.
APR-057	Install An Automatic Dishwasher.
APR-058	Replace Switches On An Automatic Dishwasher.
APR-059	Replace A Dishwasher Motor And Pump Assembly.
APR-060	Replace Automatic Dishwasher Timer.
APR-061	Replace Automatic Dishwasher Heating Element.
APR-062	Check Dishwasher For Proper Operation.
APR-063	Understand Automatic Washer Wiring Diagrams.
APR-064	Understand Fundamentals Of Microwave Ovens.
APR-065	Install Microwave Oven.
APR-066	Diagnose And Repair Microwave Oven.
APR-067	Diagnose And Repair Mark Series Microwave Ovens.
APR-068	Replace Magnetron Tube.
APR-069	Install A Window Mount Air Conditioner.
APR-070	Install Range Hood.

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TOOL AND EQUIPMENT LIST SURVEY

EQUIPMENT

Equipment Number	Equipment Description	Percentage Using	Number Using
68	Screwdriver, Phillips, Assorted	99.05	104
93	Wrench End, Assorted	99.05	104
92	Wrench, End, Adjustable 6", 10", 12"	98.10	103
22	Drill Bits, #80 to 3/8"	97.14	102
94	Wrench, Pipe - 6", 10",	97.14	102
3	Box, Tool	96.19	101
21	Drill 3/8"	96.19	101
35	Hacksaw	96.19	101
36	Hammers, Heavy and Light	96.19	101
16	Cutter, Tubing	95.24	100
65	Screws, Assorted	95.24	100
91	Wrench, Allen Assorted	95.24	100
28	Flashlight	94.29	99
54	Pliers, Vicegrip	93.33	98
66	Screwdrivers, Assorted Blade	93.33	98
11	Cord, Extension	92.38	97
24	Files, Assorted-10" and 3 Corner	92.38	97
26	Flaring Tool and Block	91.43	96
82	Tape Electrical	91.43	96
95	Wrench, Socket - 3/8", or 1/2" Drive	90.48	95
96	Wrench, Socket - 1/4" Drive or Socket Head Nut Drivers	90.48	95
98	Washers, Assorted Metal	90.48	95
9	Connectors Assorted	90.48	94

14	Crimpers, Terminal	87.62	9
64	Rule, 6'	87.62	9
52	Pliers, Needle Nose	85.71	9
86	Thermometer, Oven	84.76	8
88	Tube, Bender	83.81	8
67	Screwdrivers, Blade Offset	81.90	8
99	Washers, Assorted Rubber	81.90	86
15	Cutter, Diagonal	80.95	85
23	Fasteners, Assorted	80.95	85
47	Oil Can	80.95	85
59	Punch, Center	80.95	85
46	Ohm Meter	80.00	84
42	Level, 3" or 5"	78.10	82
79	Soldering, Iron	78.10	82
53	Pliers, Retaining Ring (Tru-Arc)	76.19	80
10	Connectors, Quick Tubing - 1/4" and 5/8"	75.24	79
51	Pliers, Gas Pipe	74.29	78
72	Sealant, Perma-Gum	74.29	78
60	Rags, Wiping	73.33	77
37	Hose Pinch Off Tool	72.38	76
81	Swaging Tool Set, 1/4", 5/16", 3/8", 1/2"	71.43	75
4	Brazing Kit	70.40	74
1	Ammeter	68.57	72
45	Mirror, Inspection	68.57	72
69	Screwdrivers, Phillips, Offset	68.57	72
25	Fire Extinguisher	67.62	71
44	Manometer	66.67	70

58	Pump, Vacuum 29.8" HG Certified	66.67	7
55	Pliers, Water Pump	65.71	6
87	Thermometer, Refrigeration	65.71	6
39	Insulation, Fiberglass	64.76	6
85	Thermometer, Mercury-Low Temp/Hi Temp	63.81	6
38	Hose, Purge	61.90	6
71	Screwstarter	60.95	64
2	Amprobe	60.00	63
63	Refrigerant R-22	59.05	62
34	Gun, Heat	58.10	61
62	Refrigerant R-12	58.10	6
70	Screwdriver, Thermostat	58.10	61
32	Glasses, Safety	55.24	58
41	Lamp, Test	55.24	58
80	Striker	55.24	58
43	Manifold Set	54.29	57
8	Comb, Fin	53.33	56
50	Pliers, Corbin	53.33	56
61	Recorder, Time Temperature	53.33	56
76	Seal Remover	53.33	56
18	Detector, Electronic	52.38	55
83	Test Adapter and Cord Set	51.43	54
90	Watt Meter	51.43	54
74	Seal Installer	50.48	53
78	Silver, 45%	50.48	53
6	Chisel, Cord-6", 9"	47.62	50
13	Cord, Refrigerant Test	47.62	50

19	Detector, Halide	45.71	48
48	Oil, Refrigeration 150 Sec	45.71	48
97	Wrench, Torque and Assorted Bits	45.71	48
20	Dial-A-Charge	44.76	47
5	Capacitor Analyzer	42.86	45
7	Cloth, Drop-Flame Retardent	39.05	41
77	Shorting Tool	39.05	41
89	Valve, High Side (VQ4S)	39.05	41
12	Cord, Fused	38.10	40
30	Gauge, Leaf Switch	38.10	40
31	Glass, Measuring	34.29	36
57	Psycrometer, Sling	32.38	34
27	Floor Cover, Heat Resistant	31.43	33
84	Test Kit, Water	31.43	33
17	Detector, Aersol	30.48	32
29	Gauge, Cam	29.52	31
75	Seal, Spare Hose	28.57	30
40	Lamp, Heat-250 Watt	25.71	27
49	Oil, Turbine	24.76	26
73	Sealant, Water Bar	24.76	26
33	Ground Monitor	23.81	25
56	Pointer, Metal Rod-1/8"	13.33	14
100	Bender, Metal	5.71	6
113	Kit, Microwave Test	4.76	5
115	Ladder, Step	4.76	5
103	Chisel, Wood	3.81	4
104	Crimpers, Metal Pipe	3.81	4

105	Cutter, Pipe	3.81	4
118	Saw, Jig/Keyhole	3.81	4
101	Bit, Expansion	2.86	3
102	Brush, Steel	2.86	3
106	Gauge, Micron	2.86	3
107	Gauge, Vacuum	2.86	3
108	Gloves, Asbestos	2.86	3
109	Grease, High Temperature	2.86	3
110	Hat, Hard	2.86	3
111	Hose, Water	2.86	3
112	Kit, First Aid	2.86	3
116	Moisture Absorber	2.86	3
114	Knife, Putty	0.95	1
117	Puller, Fuse	0.95	1
119	Snips, Tin	0.95	1
120	Studfinder	0.95	1
121	Tap and Die Set, Pipe	0.0	0
122	Tape, Masking	0.0	0
123	Tester, Thermocouple	0.0	0
124	Vacuum and Blower	0.0	0

TOTAL RESPONDENTS 105.

INSTRUCTOR'S GUIDE SHEETS

INSTRUCTOR'S GUIDE SHEET

DEMONSTRATE KNOWLEDGE OF SHOP SAFETY PRACTICES

OBJECTIVE

After studying about safe shop practices and safety rules, inspect and indentify any unsafe conditions that may exist in the shop. You will complete a written test on shop safety with a score of 100%. You will be evaluated according to the instructor's final checklist.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET.

The student will be required to identify safety hazards and demonstrate safe techniques of working in a shop.

CONTENTS	LEARNING ACTIVITY #
Instruction Sheet I - VI	1
Instructor's Final Checklist	5

CHECK-OUT ACTIVITY

Given a shop safety checklist, inspect the shop and record any unsafe conditons. Complete the written shop safety test provided by the instructor.

REFERENCES

Prentice-Hall Media, Safety At Work, Voctional Media Associates, Mount Kisco, NY.

INSTRUCTOR'S GUIDE SHEET

DEMONSTRATE KNOWLEDGE OF SHOP SAFETY PRACTICES

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have the student read the instruction sheets on shop safety.	Instruction Sheet #1 - 6.	
2.	Have the student observe a demonstration on safety practices to be followed in the shop.		
3.	Have the student view filmstrips on work safety.	Safety At Work Prentice Hall Media.	
4.	Allow the student to complete the unit test on shop safety.		
5.	Allow the student to complete the check-out activity listed for this task assignment.		
	Evaluate the student's performance according to the instructor's final checklist.	Instructor's Final Checklist.	

Instructor's Final Checklist

DEMONSTRATE KNOWLEDGE OF SHOP SAFETY PROCEDURES

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

The student performed the following:

	FULLY AC	NOT AC	NOT AP
1. Checked the equipment and materials, observed and recorded all safety discrepancies.			
2. Demonstrated lifting semi-heavy objects.			
3. Memorized the fire drill and evacuation procedures.			
4. Checked the location of fire extinguishers.			
5. Checked to see if any unsafe electrical practices exist.			
6. Identified all the good and abd housekeeping practices.			
7. Read all specified materials.			
8. Completed shop safety exams - 100%.			

INSTRUCTOR'S GUIDE SHEET

CHECK ELECTRICITY

Given a simple electrical circuit made of a battery, connecting wires, and a light bulb, indicate an understanding of the terms: voltage, current, resistance, source, conductor, and load by scoring 85% or higher on a written test. Your performance will be rated according to the instructor's final checklist.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

In this task assignment, you will be required to demonstrate an understanding of some very important electrical terms.

CONTENTS	LEARNING ACTIVITY #
Student Self-Check I	3
Instruction Sheet I	4
Instruction Sheet II	4
Instructor's Final Checklist	6

CHECK-OUT ACTIVITY

Your instructor will provide you with a battery, some connecting wires, and a light bulb. Construct a circuit by connecting the battery to the light bulb. Explain what is meant by voltage, current, resistance, source conductor, and load by using this circuit as an example.

REFERENCES

Whirlpool Corporation, Basic Electricity for Appliances, Whirlpool Corporation, Benton Harbor, MI.

INSTRUCTOR'S GUIDE SHEET

CHECK ELECTRICITY

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have the student read about properties of electricity.	Whirlpool Corporation, Basic Electricity for Appliances, pages 8-10 and 21.	
2.	Have the student observe a presentation on properties of electricity.		
3.	Have the student answer the questions in Student Self-Check I.	Student Self-Check I	
4.	Have the student read Instrction Sheet I & II	Instruction Sheet I & II.	
5.	Allow the student to practice using units of electrical measurements. measurements.	See tools and equipment list.	
6.	Allow the student to complete the check-out activity for this task assignment.	See tools and equipment list.	
	Evaluate the student's performance.	Instructor's Final Checklist.	

TOOLS AND EQUIPMENT

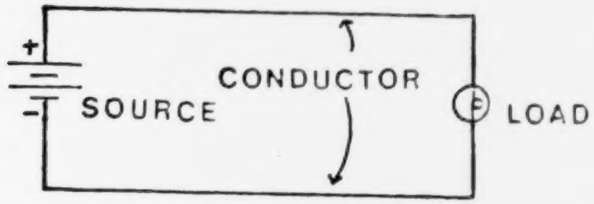
Battery - 1.5 volt, lamp and socket (.15 volt), connecting wires.

STUDENT SELF CHECK I

Answer Key

---

1. voltage
2. resistance
3. current
4. power
5. 1 amp = 1,000 milliamps, move decimal point three places to the right.
6. 1 volt = .001 kilovolts, move decimal point three places to the left.
7. .000078 amps = 78 micro amps, move decimal point six places to the right.
8. 1.2 megaohms - 1,200,00 ohms, move decimal point six places to the right.
9.



Instructor's Final Checklist

CHECK ELECTRICITY

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.	FULLY AC	NOT AC	NOT AP
While checking electricity and applying the terms of electricity, the student:			
1. Selected the proper materials.	___	___	___
2. Constructed the circuit properly.	___	___	___

INSTRUCTOR'S GUIDE SHEET

IDENTIFY PROPERTIES OF D.C. ELECTRICAL CIRCUITS

OBJECTIVE

1. Identify on a schematic diagram the three physical properties basic to an electrical circuit.
2. Identify the electrical properties which are basic to a functioning electrical circuit.
3. Measure the current flow in a D.C. circuit. You wil be rated according to the instructor's final checklist.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

You will be able to identify the properties of D. C. electrical circuits.

CONTENTS

Student Self-Check I	3
Instruction Sheet I	4 & 5

CHECK-OUT ACTIVITY

Your instructor will provide you with a list of incomplete statements related to identifying the properties of D.C. electrical circuits and a list of terms phrases, and numbers; you will select the one that best completes each statement.

Your instructor will provide you with a schematic of a simple D.C. circuit and the necessary components to construct the circuit and mesure current flow with a meter.

REFERENCES

Meyerink, G., (1973), Appliance Service Handbook, Prentice-Hall, Inc., Englewood Cliffs, NJ.

INSTRUCTOR'S GUIDE SHEET

IDENTIFY PROPERTIES OF D.C. ELECTRICAL CIRCUITS

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have the student read about D.C. electrical circuits.	Meyerink, Appliance Service Handbook, pages 96-105.	
2.	Have the student observe a presentation on D.C. electrical circuits.		
3.	Allow the student to complete Student Self Check I.	Student Self-Check I.	
4.	Allow the student to practice the activity in Instruction Sheet I.	Intruction Sheet I.	
5.	Allow the student to complete the check-out activities.	Instruction Sheet I	
	Evaluate the student's performance.	Instructor's Final Checklist.	

TOOLS AND EQUIPMENT

Circuit boards, VOM.

STUDENT SELF CHECK I

Answer Key

---

1. h
2. k
3. c
4. f
5. m
6. p
7. o
8. a
9. d
10. e
11. l
12. i

Instructor's Final Checklist

IDENTIFYING PROPERTIES OF D.C. ELECTRICAL CIRCUITS

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In identifying properties of D.C. electrical circuits, the student:

	FULLY AC	NOT AC	NOT AP
1. Constructed the circuit according to the schematic diagram.	___	___	___
2. Determined the direction of current flow in the circuit.	___	___	___
3. Connected the meter in series with current path.	___	___	___
4. Set the meter on the correct scale.	___	___	___
5. Read the meter correctly.	___	___	___

DEFINE ELECTRICAL QUANTITIES

OBJECTIVES

1. Define voltage or electromotive force and determine voltage in a D.C. circuit.
2. Identify the characteristics of resistance and determine resistance in a D.C. circuit.
3. Identify Ohm's Law and apply Ohm's Law in defining the quantities in a D.C. circuit.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

You will demonstrate your sbility to define electrical quantities.

CONTENTS	LEARNING ACTIVITY #
Student Self-Check I	3
Student Self-Check II	3
Student Self-Check III	3
Check-Out Activity Sheet	4
Instructor's Final Checklist	4

CHECK-OUT ACTIVITY

Your instructor will provide you with a list of incomplete statements related to defining electrical quantities and a list of terms, phrases, and numbers; select the response that best completes each statement.

REFERENCES

Meyerink, G., (1973), Appliance Service Handbook, Prentice-Hall, Inc., Englewood Cliffs, N.J.

INSTRUCTOR'S GUIDE SHEET

DEFINE ELECTRICAL QUANTITIES

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have the student read in a text about electrical quantities.	Meyerink, *Appliance Service Handbook,* pages 96-105.	
2.	Have the student observe a lecture on (1) voltage, (2) resistance, (3) Ohm's Law.		
3.	Allow the student to complete Student Self-Checks I, II, and III.	Student Self-Checks I, II, and III.	
4.	Allow the student to complete the check-out activity for this task assignment.	Check-Out activity	
	Evaluate the student's performance.	Instructor's Final Checklist.	

STUDENT SELF-CHECK I

Answer Key

---

1. j
2. b
3. d
4. l
5. h
6. r
7. p
8. f
9. n
10. a
11. t
12. i
13. g
14. s
15. o
16. k
17. e
18. c
19. u
20. m
21. q

STUDENT SELF-CHECK II

Answer Key

---

1. k
2. d
3. h
4. b
5. p
6. i
7. j
8. m
9. g
10. o
11. e
12. a
13. l
14. c
15. f

STUDENT SELF-CHECK III

Answer Key

---

1. j
2. k
3. b
4. o
5. d
6. c
7. m
8. i
9. f
10. i
11. e
12. h
13. n
14. g
15. l

Check-Out Activity

DEFINE ELECTRICAL QUANTITIES

Select from the list below the word or phrase that best completes each of the following statements. Write the letter of your choice in the space provided.

a. Inversely
b. Flows
c. 20 Ohms
d. Directly
e. Coulomb
f. 40 Ohms
g. Positive
h. Increases
i. Improperly
j. 2200 Ohms
k. R_1
l. Force
m. 4.5 watts
n. Applied
o. R_2
p. Recharges
q. 24 volts
r. Half
s. .05 Ohms
t. Temperature
u. Series Aiding
v. Resistance
w. 0 Ohms
x. Resistivity

_____ 1. Electromotive force, (emf) and potential difference are names for the _____________ which we call voltage.

_____ 2. Ampere is the unit of current, joule is a unit of energy, and __________ is a unit of charge.

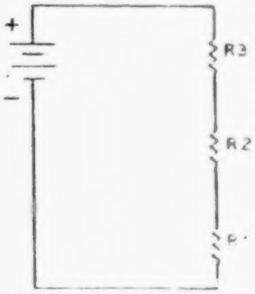
_____ 3. A secondary cell is one that can be ____________.

_____ 4. To double the voltage, two cells must be connected in the __________.

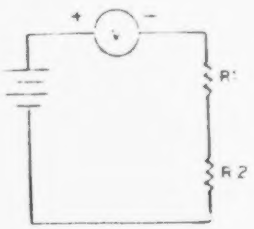
_____ 5. A voltage drop exists only when current ____________ in the circuit.

_____ 6. If two resistors are identical, each must drop ______________ of the applied voltage.

_____ 7. In this circuit if R_1 is replaced with a piece of wire, what happens to the voltage drop across R_2?



_____ 8. This diagram shows a volt meter ___________ connected to measure voltage drop.



Check-Out Activity (page 2)

_____ 9. An Ohm is defined as the amount of resistance which will allow one ampere of current to flow when one volt of emf is _______________.

_____ 10. _______________ is defined as the resistance of a one mil-foot length of a substance of 20 degrees Celcius.

_____ 11. The resistance of an insulated wire is determined by its length, cross-sectional area _______________ and resistivity.

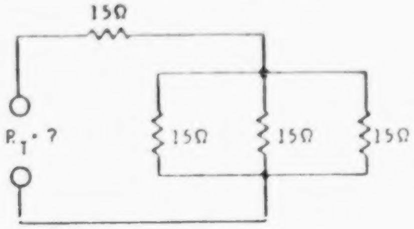
_____ 12. The resistance of 20 Ohm's equals a conductance of ____________.

_____ 13. The resistance of a conductor is directly proportional to its length and ____________ proportional to its cross-sectional area.

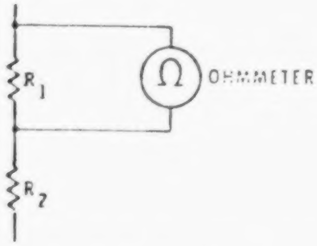
_____ 14. The resistance of a certain substance increases when the temperature increases, therefore, it is said to have a ____________ temperature coefficient.

_____ 15. A resistor has three red bands, its total value is _______________.

_____ 16. What is R_T shown in this diagram.



_____ 17. This diagram shows the proper method for measuring __________, with two resistors in a circuit.



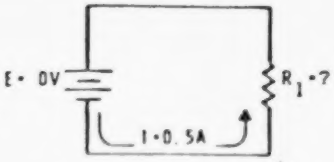
_____ 18. Ohm's Law states that current is inversely proportional to resistance and _______ proportional to voltage.

_____ 19. Ideally, the resistance of an ammeter should be ____________.

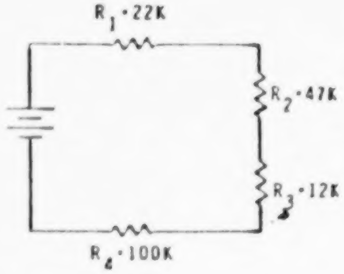
_____ 20. __________ of power is dissipated by a resistor which drops 6 volts when the current through it is 0.75 amperes.

_____ 21. __________ of voltage drop will be needed across a 12 k Ohm resistor when the current through that resistor is 2 milliamperes.

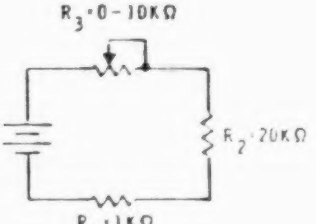
_____ 22. In this electrical diagram determine the value of R_1.



_____ 23. Which resistor dissipates the most power?


R_1 = 22K
R_2 = 47K
R_3 = 12K
R_4 = 100K

_____ 24. A fairly accurate indication of the current flowing in this curcuit can be found by measuring __________.


R_3 = 0 - 10KΩ
R_2 = 20KΩ
R_1 = 1KΩ

CHECK-OUT ACTIVITY

Answer Key

---

1. l
2. e
3. p
4. u
5. b
6. r
7.
8. i
9. n
10. x
11. t
12. s
13. a
14. g
15. j
16. c
17. v
18. d
19. w
20. m
21. q
22. c
23. o
24. k

INSTRUCTOR'S FINAL CHECKLIST

DEFINING ELECTRICAL QUANTITIES

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

The Student:	FULLY AC	NOT AC	NOT AP
I. Identified the different terms for voltage.	____	____	____
2. Identified a unit of charge.	____	____	____
3. Identified the changability of a secondary cell.	____	____	____
4. Determined how to connect two cells to double the voltage.	____	____	____
5. Determined when it is to possible to determine voltage drop in a circuit.	____	____	____
6. Identified the voltage drop of two identical resistors, as well as well as different resistors in series.	____	____	____
&. Identified the proper hook up and a volt meter to measure voltage drop.	____	____	____
*. Identified the moving force of an electrical circuit.	____	____	____
9. Identified resistivity.	____	____	____
10. Identified the different aspects of a length of wire that affect resistance.	____	____	____
11. Identified resistance in relation to the cross sectional area.	____	____	____

12. Identified resistance in relation to temperature coefficient. _____ _____ _____

13. Identified the color bands on a resistor. _____ _____ _____

14. Determined R_T of a circuit with a resistor. _____ _____ _____

15. Identified the proper hook up of an ohmmeter with two resistors in a circuit. _____ _____ _____

16. Identified Ohm's Law in regard to current. _____ _____ _____

17. Identified the desired resistance in an ammeter. _____ _____ _____

18. Identified the proper wattage of dissipated power. _____ _____ _____

19. Determine resistance value. _____ _____ _____

INSTRUCTOR'S GUIDE SHEET

USE A VOM TO MEASURE ELECTRICAL QUANTITIES

OBJECTIVE

1. Determine the value of electrical quantities in a simple D.C. circuit.
2. Measure electrical quantities in a simple D.C. circuit using a volt ohm meter (VOM)

You will be rated according to the instructor's final checklist.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

You will demonstrate your knowledge of the use of a volt-ohm-miliameter.

CONTENTS	LEARNING ACTIVITY #
Student Self-Check I "Electrical Measurements"	3
Check-Out Activites "Electrical Measurements"	5

CHECK-OUT ACTIVITIES

Your instructor will provide you with a list of questions relating to determining and measuring electrical quantities with a VOM. Using what you have learned in this task assignment, answer the questions with an accuracy of at least 85%.

REFERENCES

Meyerink, G., (1973), Appliance Service Handbook, Prentice-Hall, Inc., Englewood Cliffs, NJ.

INSTRUCTOR'S GUIDE SHEET

USE A VOM TO MEASURE ELECTRICAL QUANTITIES

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have the student read about measuring electrical quantities.	Meyerink, Appliance Service Handbook, pages 96-116.	
2.	Have the student observe a demonstration of the use of a VOM.		
3.	Have the student complete Student Self-Check I.	Student Self-Check I, "Electrical Measurements"	
4.	Allow the student to practice using a VOM to measure electrical quantities.	See tools and equipment list.	
5.	Allow the student to complete the check-out activities for this task assignment.	Check-Out Activities "Electrical Measurements"	
	Evaluate the student's performance.	Instructor's Final Checklist.	

TOOLS AND EQUIPMENT

VOM, various appliance for test readings.

STUDENT SELF-CHECK I

Answer Key

---

1. k
2. i
3. g
4. q
5. c
6. a
7. h
8. d
9. n
10. o
11. j
12. f
13. p
14. m
15. b
16. r
17. l
18. e

Check-Out Activity

ELECTRICIAL MEASUREMENTS

Select from the list below the word or phrase that best completes each of the following statements. Write the letter of your choice in the space provided.

A. ohmmeter
B. scale
C. 20,000
D. d'Arsonval
E. 1
F. voltmeter
G. ammeter
H. 2
I. jeweled
J. 15
K. Resistance
L. 9,000

_____ 1. The __________ meter movement is characterized by a moving-coil which rotates in the field of a permanent magnet.

_____ 2. The taut-band meter movement used thin metal bands to replace pivots, __________ bearings, and spiral springs of the conventional movement.

_____ 3. The range of the __________ is increased by placing a resistor in parallel with the meter movement.

_____ 4. The range of the __________ is increased by placing a higher value dropping resistor in series with the meter movement.

_____ 5. The accuracy of a meter is specified as a percentage of error at full __________ deflection.

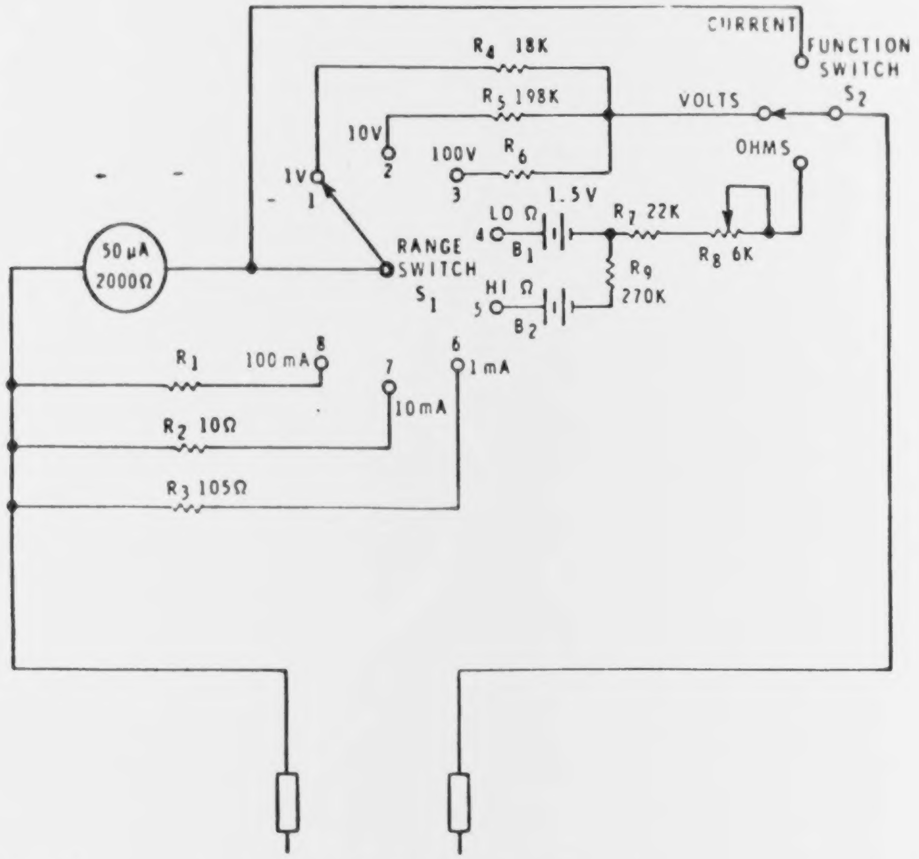
_____ 6. To minimize the loading effect of a voltmeter the __________ of the voltmeter should be as high as possible.

_____ 7. The basic series __________ circuit can be modified to measure lower values of resistance by placing a low value resistor in parallel with the meter movement and its series resistance.

_____ 8. A 9 volt battery is used in conjunction with a (lma) meter movement and a series resistance to form a series ohmmeter. What is the half-scale reading of this ohmmeter? __________ ohms.

Check-Out Activity (page 2)

When answering the next four questions you will need to refer to the diagram below.


CURRENT
FUNCTION SWITCH
R_4 18K
R_5 198K
VOLTS
S_2
10V
2
100V
R_6
3
OHMS
1V
1
1.5V
LO Ω
4
B_1
R_7 22K
R_8 6K
50 μA
2000Ω
RANGE SWITCH
S_1
HI Ω
5
B_2
R_9
270K
R_1
100 mA
8
7
10mA
6
1 mA
R_2 10Ω
R_3 105Ω

_____ 9. Refer to the multimeter diagram above. What is the sensitivity of the meter movement used in this instrument? ______________ ohm(s) per volt.

_____ 10. Refer to the multimeter diagram above. What is the value of R_6? ________________ M .

_____ 11. Refer to the multimeter diagram above. If the HI range is ten times higher than the LO range, voltage should B_2 be? ________________ volt(s).

_____ 12. Refer to the multimeter diagram above. What is the proper value of R_1? ______________ ohm(s).

CHECK-OUT ACTIVITIES

Answer Key

---

1. d
2. i
3. g
4. f
5. b
6. k
7. a
8. l
9. c
10. h
11. j
12. e

INSTRUCTOR'S FINAL CHECKLIST

USE A VOM TO MEASURE ELECTRICAL QUANTITIES

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

		FULLY AC	NOT AC	NOT AP
1.	The student identified the meter movement which rotates in the field of a permanent magnet.			
2.	The student identified the bearings used in the taunt band meter movement.			
3.	The student identified the meter when the range is increased by placing a resistor in parallel with the meter movement.			
4.	The student identified the meter when the range is increased by placing a higher value dropping resistor in series with the meter movement.			
5.	The student identified the accuracy of a meter and its deflection.			
6.	The student determined how to minimize the loading effect of a voltmeter.			
7.	The student identified the effect of modification to lower values of resistance.			
8.	The student identified the half-scale reading of a given ohmmeter.			
9.	The student identified the sensitivity of the meter movement on a designated multimeter.			

10. The student identified the value of resistance 6 in a designated multimeter diagram. _____ _____ _____

11. The student identified the voltage of battery in a designated multimeter. _____ _____ _____

12. The student identified the value of resistor 1 in a designated multimter diagram. _____ _____ _____

INSTRUCTOR'S GUIDE SHEET

MEASURE RESISTANCE

OBJECTIVE

Your instructor will provide you with several components and a meter. Use the meter to measure accurately the resistance of the components. You will be rated according to the Instructor's Final Checklist.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

You will demonstrate your ability to measure resistance in an electrical circuit using a meter.

CONTENTS	LEARNING ACTIVITY #
Instruction Sheet I	2
Student Self-Check I	3
Instruction Sheet II	4
Student Self-Check II	6
Instructor's Final Checklist	7

Check-Out Activity

Given various components and a VOM, measure the resistance value of each component. Readings must agree with those provided by the instructor.

REFERENCES

Whirlpool Corporation, Basic Electricity for Appliances, Whirlpool Corporation, Benton Harbor, MI.

INSTRUCTOR'S GUIDE SHEET

MEASURE RESISTANCE

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have the student read text material on basic electricity.	Whirlpool Corporation, Basic Electricity for Appliances, pages 26, 29-31, and 83-86.	
2.	Have the student read Instruction Sheet I.	Instruction Sheet I	
3.	Have the student practice color-coding.	Student Self-Check I	
4.	Have the student read Instruction Sheet II.	Instruction Sheet II	
5.	Allow the student to practice measuring resistance.	See tools and equipment list.	
6.	Have the student complete Student Self-Check II.	Student Self-Check II	
7.	Allow the student to complete the check-out activity listed for this task assignment.	See tools and equipment list.	
	Evaluate the student's performance.	Instructor's Final Checklist.	

TOOLS AND EQUIPMENT

Assorted color-coded resistors, VOM, Potentiometer, resistors.

Answers to Self Check I

1. #1 220 #2 100,000

2. See Instructor's Manual

Student Self-Check II

MEASURING RESISTANCE

Answer the following questions. Then check your answers with those at the bottom of the page.

1. On which part of the ohms scale are the most accurate resistance measurements made?
2. What is meant by the X1,000 range on the ohmmeter?
3. What is meant by "zeroing" the ohmmeter?
4. Why is it necessary to zero the ohmmeter?
5. If the range of the ohmmeter is adjusted to X100,000 and the needle points to .6 on the ohms scale, what would be the value of the resistance being measured?
6. What is indicated by the first and second color bands of a color coded resistor?
7. What is indicated by the third color band of a color coded resistor?
8. What is indicated by the fourth color band of a color coded resistor?
9. What unit of electrical measurment is used to indicate resistance?
10. If a fourth color band is not indicated on a resistor, what is its' tolerance value?

Answers:
1. The most accurate resistance measurements are made between the left side of the scale and the center because the divisions are further apart.
2. The number that the needle moves to on the scale must be multiplied by 1,000; for example: 3.8 X 1,000 = 3,8000 ohms.
3. The meter test probes are touched together to cause the needle to move to the left side of the meter scale.
4. The needle is adjust to zero using the "ohms adjust" in order to get an accurate resistance measurement; it should be adjusted whenever the meter range is changed. This is a form of calibration.
5. .6 X 100,000 = 60,000 ohms.
6. The first color band is the first digit. The second color band is the second digit.
7. The third color band is the multiplier or number of zeros to be added.
8. The fourth color band indicates the tolerance of the resistor.
9. Ohms.
10. ±20%.

INSTRUCTOR'S FINAL CHECKLIST

MEASURE RESISTANCE

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.	FULLY AC	NOT AC	NOT AP
While measuring resistance with a meter the student:			
1. Selected the proper tools.			
2 Selected the proper meter "function" settings.			
3. Selected the proper meter "range" settings.			
4. Read the scale of the meter accurately.			
5. Used the proper meter range multiplier for determining resistance accurately.			
6. Place the meter probes into the correct terminals for measuring resistance.			
7. Connected the meter to the component being measured properly.			
8. Adjusted the meter needle to the zero mark on the scale when over the meter range setting was changed.			
9. Performed all tasks in a safe manner.			

INSTRUCTOR'S GUIDE SHEET

MEASURE VOLTAGE

OBJECTIVE

Given selected electrical circuits and a VOM, measure the voltage in the circuits. Readings must agree with those of the instructor. Your performance will be rated according to the instructor's final checklist.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

You will demonstrate your ability to measure voltage in an electrical circuit with a meter.

CONTENTS	LEARNING ACTIVITY #
Student Self-Check I	3
Instruction Sheet I	4 & 5
Instructor's Final Checklist	6

CHECK-OUT ACTIVITY

Your instructor will provide you with the necessary materials to construct some simple electrical circuits. Construct the circuits and use a VOM meter to measure the voltage accurately at points designated by the instructor.

REFERENCES

Whirlpool Corporation, Basic Electricity for Appliances, Whirlpool Corporation, Benton Harbor, MI.

INSTRUCTOR'S GUIDE SHEET

MEASURE VOLTAGE

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have the student read about measuring voltage.	Whirlpool Corporation, Basic Electricity for Appliances, pages 24-25, and 89-90.	
2.	Have the student observe a demonstration on measuring voltage.		
3.	Have the student complete Student Self-Check I.	Student Self-Check I	
4.	Have the student read Instruction Sheet I.	Instruction Sheet I	
5.	Allow the student to practice measuring voltage in circuits.	Instruction Sheet I See tools and equipment list.	
6.	Allow the student to complete the check-out activiity listed for this task assignment.	See tools and equipment list.	
	Evaluate the student's performance.	Instructor's Final Checklist.	

TOOLS AND EQUIPMENT

VOM, potentiometer, resistors, 6-volt battery, lamp with socket (6 volt), connecting wires.

INSTRUCTOR'S FINAL CHECKLIST

MEASURE VOLTAGE

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

While measuring voltage with a meter, the student:

	FULLY AC	NOT AC	NOT AP
1. Selected the proper materials.	____	____	____
2. Constructed the circuits properly.	____	____	____
3. Selected the proper meter "function" settings.	____	____	____
4. Selected the proper meter "range" settings.	____	____	____
5. Read the scale of the meter accurately.	____	____	____
6. Observed proper meter polarity when making measurements.	____	____	____
7. Connected the meter in the circuit properly.	____	____	____
8. Performed all tasks in a safe manner.	____	____	____

INSTRUCTOR'S GUIDE SHEET

MEASURE CURRENT

OBJECTIVE

Given simple electrical circuits and an ammeter, measure current in the circuits. Readings must agree with those of the instructor.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

You will demonstrate your ability to measure current in an electrical circuit using a meter.

CONTENTS	LEARNING ACTIVITY #
Student Self-Check I	3
Instruction Sheet I	4 & 5
Instructor's Final Checklist	6

CHECK-OUT ACTIVITIES

Your instructor will provide you with the necessary materials to construct simple electrical circuits. Construct the circuits and use a meter to measure current in the circuits accurately. You will be rated according to the instructor's final checklist.

REFERENCES

Whirlpool Corporation, Basic Electricity for Appliances, Whirlpool Corporation, Benton Harbor, MI.

INSTRUCTOR'S GUIDE SHEET

MEASURE CURRENT

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have the student read about measuring current in an electrical circuit.	Whirlpool Corporation, Basic Electricity for Appliances, page 25.	
2.	Have the student observe a demonstration on measuring current.		
3.	Have the student complete Student Self-Check I.	Student Self Check I	
4.	Have the student read Instruction Sheet I.	Instruction Sheet I	
5.	Allow the student to practice measuring current in an electrical circuit.	Instruction Sheet I See tools and equipment list.	
6.	Allow the student to complete the check-out activity for this task assignment.	See tools and equipment list.	
	Evaluate the student's performance.	Instructor's Final Checklist.	

TOOLS AND EQUIPMENT

VOM, resistors, 6-volt battery, SPST switch, connecting wires.

INSTRUCTOR'S FINAL CHECKLIST

MEASURE CURRENT

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

While learning to measure current with a meter, the student:

	FULLY AC	NOT AC	NOT AP
1. Selected the proper materials.	____	____	____
2. Constructed the circuits properly.	____	____	____
3. Selected the proper meter "function" settings.	____	____	____
4. Selected the proper meter "range" settings.	____	____	____
5. Read the scale of the meter accurately.	____	____	____
6. Observe proper meter polarity when making measurements.	____	____	____

INSTRUCTOR'S GUIDE SHEET

APPLY BASIC ELECTRICAL THEORY

OBJECTIVE

After you have completed this task assignment, you will be able to calculate values for current, resistance, and voltage which will agree with meter readings. You will be rated according to the instructor's final checklist.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

You will demonstrate your ability to apply Ohm's Law to basic electrical circuits.

CONTENTS	LEARNING ACTIVITY #
Student Self-Check I	3
Instruction Sheet I	4 & 5
Instructor's Final Checklist	6

CHECK-OUT ACTIVITY

Given various electrical circuits, a VOM, and the necessary formulas, calcuate values for current, resistance, and voltage. Calculated values must agree with meter readings.

REFERENCES

Whirlpool Corporation, Basic Electricity for Appliances, Whirlpool Corporation, Benton Harbor, MI.

INSTRUCTOR'S GUIDE SHEET

APPLY BASIC ELECTRICAL THEORY

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have the student read about basic electrical theory.	Whirlpool Corporation, Basic Electricity for Appliances, pages 27-28.	
2.	Have the student practice on problems applying basic electric theory.		
3.	Have the student complete Student Self-Check I.	Student Self-Check I	
4.	Have the student read Instruction Sheet I.	Instruction Sheet I	
5.	Have the student practice applying basic electrical theory.	Instruction Sheet I See tools and equipment list.	
6.	Allow the student to complete the check-out activity for this task assignment.	See tools and equipment list.	
	Evaluate the student's performance.	Instructor's Final Checklist.	

TOOLS AND EQUIPMENT

VOM, assorted resistors, variable DC power supply, connecting wires.

STUDENT SELF-CHECK I

Answer Key

---

1. Current is doubled.
2. Current is one-half its original value.
3. E = I x R = .010A x 10 = volts.
4. R = E/I = 10V/.001A = 10,000.
5. I = E/R = 1V ohm = 1 amp
6. (1) R = E/I = 120V/.20A = 600 ohm
   (2) E = I x R = .25A x 25 ohm = 6.25 volts
   (3) E = I x R = 7.5A x .84 ohm = 6.3 volts
   (4) E = 2A x 50 ohm = 100 volts
   (5) E = .6A x 240 ohm = 144 volts
   (6) R = E/I = 120V/.15A = 800 ohm
   (7) I = E/R = 120V/20 ohm = 6 amps
   (8) R = E/I = 50V/.05A = 1,000
   (9) I = 12V/A ohm = .15 amps
   (10) R = 12V/90 ohm = .133
   (11) I = 120V/5,000 ohm = .024 amps
   (12) I = 120V/50 ohm = 2.4 amps

INSTRUCTOR'S FINAL CHECKLIST

APPLY BASIC ELECTRICAL THEORY

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

While learning to apply basic electrical theory, the student:

	FULLY AC	NOT AC	NOT AP
1. Selected the proper materials.			
2. Constructed the circuits properly.			
3. Calculated current according to Ohm's Law.			
4. Calculated voltage according to Ohm's Law.			
5. Calculated resistance according to Ohm's Law.			
6. Used the meter to measure voltage correctly.			
7. Used the meter to measure current correctly.			
8. Performed all tasks in a safe manner.			

INSTRUCTOR'S GUIDE SHEET

WORK WITH ELECTRICAL COMPONENTS, SYMBOLS, AND DIAGRAMS

OBJECTIVE

Given various simple electrical components, identify and draw their symbols, and construct simple circuits using electrical diagrams and symbols. Identification and drawings should agree with those of the instructor. You will be rated according to the instructor's final checklist.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

You will identify some common electrical components and demonstrate your ability to recognize the symbols for each component.

CONTENTS	LEARNING ACTIVITY #
Student Self-Check I	3
Instruction Sheet I	4 & 5
Instructor's Final Checklist	6

CHECK-OUT ACTIVITY

Your instructor will provide you with several simple electrical components. You will identify the components, draw their symbols, and construct the simple circuits using diagrams and symbols.

REFERENCES

Whirlpool Corporation, Basic Electricity for Appliances, Whirlpool Corporation, Benton Harbor, MI.

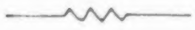
STUDENT SELF-CHECK I

Answer Key

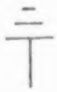
---

1. To simplify diagrams of equipment, to conserve space in diagrams, use of symbols makes it easy to draw or interpret diagrams.

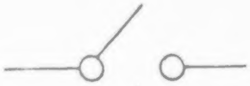
2.



A. Resistor

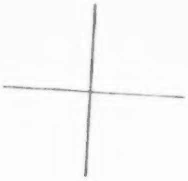


B. Ground Connection

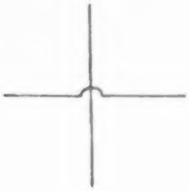


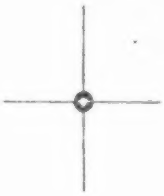
C. SPST Switch

3.



or

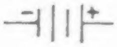




Conductor's Crossing

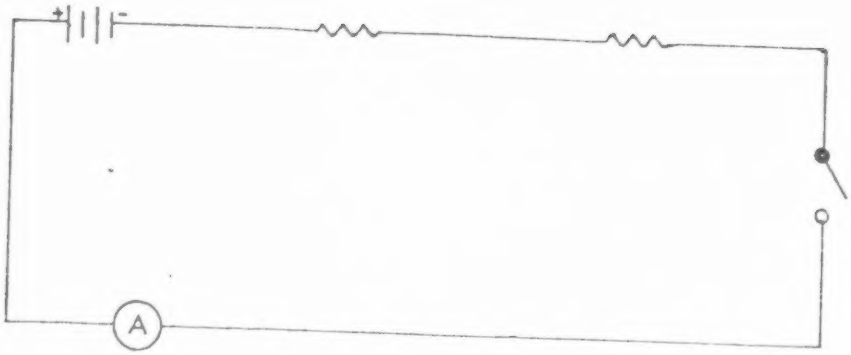
Conductor's Connected

4.



5. (a) volts
(b) amps
(c) ohms
(d) milliamps

6.



INSTRUCTOR'S GUIDE SHEET

WORK WITH ELECTRICAL COMPONENTS, SYMBOLS, AND DIAGRAMS

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have the student read about electrical symbols and diagrams.	Whirlpool Corporation, Basic Electricity for Appliances, pages 22-24 and 136-138.	
2.	Have the student observe a discussion on electrical components, symbols, and diagrams.		
3.	Have the student complete Student Self-Check I.	Student Self-Check I	
4.	Have the student read Instruction Sheet I.	Instruction Sheet I	
5.	Have the student practice identifying components, symbols and diagrams.	See tools and equipment list.	
6.	Allow the student to complete the check-out activity listed for this task assingment.	See tools and equipment list.	
	Evaluate the student's performance.	Instructor's Final Checklist.	

TOOLS AND EQUIPMENT

SPST switch, resistors, potentiometer, connecting wires, 1.5 volt battery, 1.5 volt lamp with socket.

INSTRUCTOR'S FINAL CHECKLIST

WORK WITH ELECTRICAL COMPONENTS, SYMBOLS, AND DIAGRAMS

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

The student:	FULLY AC	NOT AC	NOT AP
1. Selected the proper materials.	_____	_____	_____
2. Identified the electrical components properly.	_____	_____	_____
3. Identified the symbols for each component properly.	_____	_____	_____
4. Constructed each circuit properly.	_____	_____	_____
5. Performed all tasks in a safe manner.	_____	_____	_____

INSTRUCTOR'S GUIDE SHEET

CHECK FOR MAGNETISM AND ELECTROMAGNETISM

OBJECTIVE

Your instructor will provide you with a set of bar magnets, a compass, and the necessary materials to construct an electromagnet. Use the bar magnets and the electromagnet you construct to make observations and measurements which show the presence of magnetism and electromagnetism. You will be rated according to the instructor's final checklist.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

You will demonstrate your understanding of magnetism and electromagnetism.

CONTENTS	LEARNING ACTIVITY #
Student Self-Check I "Understanding Magnetism and Electromagnetism"	3
Instruction Sheet I "Checking for Magnetism and Electromagnetism"	4
Instructor's Final Checklist	6

CHECK-OUT ACTIVITY

Given a set of bar magnets, a compass, and the materials to construct an electromagnet, make observations and measurements which indicate the presence of magnetism and electromagnetism. Your finds must agree with pre-recorded results.

REFERENCES

Whirlpool Corporation, Basic Electricity for Appliances, Whirlpool Corporation, Benton Harbor, MI.

INSTRUCTOR'S GUIDE SHEET

CHECK FOR MAGNETISM AND ELECTROMAGNETISM

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have the student read about magnetism and electromagnetism.	Whirlpool Corporation, Basic Electricity for Appliances, pages 39-51.	
2.	Have the student observe a demonstration on magnetism.		
3.	Have the student complete Student Self-Check I.	Student Self-Check I	
4.	Have the student read the instruction sheet.	Instruction Sheet I	
5.	Allow the student to practice checking magnetism on an appliance.	See tools and equipment list.	
6.	Allow the student to complete the check-out activities listed for this task assignment.	See tools and equipment	
	Evaluate the student's performance.	Instructor's Final Checklist.	

TOOLS AND EQUIPMENT

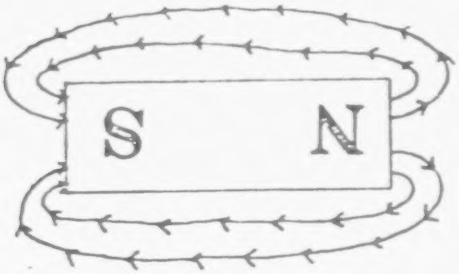
Permanent magnets (2), compass, soft iron core (3/4" diameter X 6" long), wire - #12X20" long, variable DC power supply, VOM, wound coil - 2" dia #18 wire open center.

STUDENT SELF-CHECK I

Answer Key

---

1. Unlike poles attract one another and like poles repel one another.
2. By stroking it in one direction with a magnetic for a short period of time.
3. Magnetic energy which is present around a magnet or electromagnet.
4. From north to south polarities.
5.



6. A coil of wire, usually placed around a soft iron core; voltage is applied to the coil to produe a magnetism.
7. (1) the number of turns of wire in the coil, (2) the voltage applied to the coil (or current), (3) the type of iron core used.

INSTRUCTOR'S FINAL CHECKLIST

CHECK FOR MAGNETISM AND ELECTROMAGNETISM

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

While developing an understanding of magnetism and electromagnetism, the student:

	FULLY AC	NOT AC	NOT AP
1. Selected the proper materials.	____	____	____
2. Used the bar magnets properly.	____	____	____
3. Used the compass properly.	____	____	____
4. Constructed the electromagnet properly.	____	____	____
5. Measured current through the electromagnet correctly.	____	____	____
6. Identified north and south polarities correctly.	____	____	____
7. Performed all tasks in a safe manner.	____	____	____

INSTRUCTOR'S GUIDE SHEET

WORK WITH SERIES CIRCUITS

OBJECTIVE

Given a series electrical circuit and a VOM, measure the resistance, voltage and current values in the circuit. Readings must agree with predetermined values. You will be rated according to the instructor's final checklist.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

You will demonstrate your understanding of the characteristics of a series circuit.

CONTENTS	LEARNING ACTIVITY #
Student Self-Check I	3
Instruction Sheet I	4
Instructor's Final Checklist	6

CHECK-OUT ACTIVITY

Your instructor will provide you with the necessary materials to construct a series electrical circuit. Construct the circuit and use a meter to measure the resistance, voltage, and current values of the circuit.

REFERENCES

Whirlpool Corporation, Basic Electricity for Appliances, Whirlpool Corporation, Benton Harbor, MI.

INSTRUCTOR'S GUIDE SHEET

WORK WITH SERIES CIRCUITS

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have the student read about series circuit in a text.	Whirlpool Corporation, Basic Electricty for Appliances, page 25.	
2.	Have the student observe a lecture on series circuits.		
3.	Have the student complete Student Self-Check I.	Student Self-Check I	
4.	Have the student read Instruction Sheet I "Working With Series Circuits."	Instruction Sheet I	
5.	Allow the student to practice working with a series circuit.	See tools and equipment list.	
6.	Allow the student to complete the check-out activities for this task assignment.	Instructor's Final Checklist.	
	Evaluate the student's performance.	Instructor's Final Checklist.	

TOOLS AND EQUIPMENT

Circuit board, wire, electrical component parts, VOM.

STUDENT SELF-CHECK I

Answer Key

---

1. a. There is only one path for flow of current.
   b. Current is the same value everywhere in the circuit.
   c. The voltage drops, when added together, will equal the voltage applied to the circuit.
   d. The total resistance of the circuit is found by adding the values of all resistances in the circuit.

2. 4 volts, since the voltage drop across R_1 is 6 volts and the sum of the voltage drops in a circuit equals the voltage applied. 10 volts - 6 volts = 4 volts.

3. $R = R_1 + R_2 = R_3$, so 6 + 8 + 10 = 24.

4. 2 amps, since current is the same value everywhere in a series circuit.

5. one

6. 8 volts, since this is the applied voltage.

7. (1/3) one third, since they are equal values and there are three of them.

INSTRUCTOR'S FINAL CHECKLIST

WORK WITH SERIES CIRCUITS

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

While working with a series circuit, the student:

	FULLY AC	NOT AC	NOT AP
1. Selected the proper materials.	____	____	____
2. Constructed the circuit properly.	____	____	____
3. Used the meter to measure circuit resistance properly.	____	____	____
4. Used the meter to measure circuit resistance properly.	____	____	____
5. Used the meter to measure circuit current properly.	____	____	____
6. Recorded the measured values correctly.	____	____	____
7. Performed all tasks in a safe manner.	____	____	____

INSTRUCTOR'S GUIDE SHEET

WORK WITH PARALLEL CIRCUITS

OBJECTIVE

Your instructor will provide you with the necessary materials to construct a parallel electrical circuit. Construct the circuit and use a meter to measure the resistance, voltage, and current values of the circuit. You will be rated according to the instructor's final checklist.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

You will demonstrate your knowledge of the characteristics of a parallel circuit.

CONTENTS	LEARNING ACTIVITY #
Student Self-Check I	3
Instruction Sheet I	4
Instructor's Final Checklist	6

CHECK-OUT ACTIVITY

Given a parallel electrical circuit and a VOM, measure the resistance, voltage, and current values in the circuit. Readings must agree with predetermined values.

REFERENCES

Whirlpool Corporation, Basic Electricity for Appliances, Whirlpool Corporation, Benton Harbor, MI.

INSTRUCTOR'S GUIDE SHEET

WORK WITH PARALLEL CIRCUITS

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have the student read about parallel circuits.	Whirlpool Corporation, Basic Electricity for Appliances, pages 21-22.	
2.	Have the student observe a presentation on working with parallel circuits.		
3.	Have the student complete the Student Self-Check I.	Student Self-Check I	
4.	Have the student read Instruction Sheet I.	Instruction Sheet I.	
5.	Allow the student to practice working with prepared parallel circuits.		
6.	Allow the student to complete the check-out activites listed for this task assignment.		
	Evaluate the student's performance.	Instructor's Final Checklist.	

TOOLS AND EQUIPMENT

VOM, Variable DC power supply, resistors, connecting wires.

STUDENT SELF-CHECK I

Answer Key

---

1. a. There are two or more paths for the flow current.
   b. The voltage across each path is the same.
   c. The sum of the currents in each path will equal the total current flowing from the voltage source.
   d. The total resistance is calculated by using the formula:

$$1/R_T = 1/R_1 + 1/R_2 + 1/R_3$$

2. $I_{R3} = I_T = (I_{R1} + 1_{R2} + I_{R4})$

$= 3A = (.5A + .75A + 1A)$

$= 3A - 2.25A$

$I_{R3} = .75\ A$, since the sume of the current through each path equals the total current which flows from the voltage source.

3. $1/R_T = 1/R_T + 1/R_2 + 1/R_3 + 1/R_4$ $\qquad I_T = E/R_T = 2V/.74 = 2.74A$

$= 1/2 + 1/2 + 1/4 + 1/10$

$= .5 + .5 + .25 + .1$

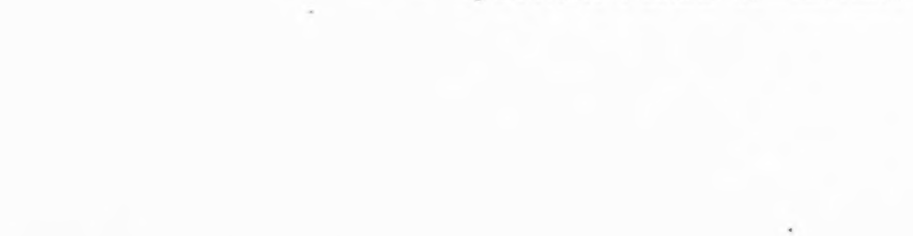
$1/R_T = 1.35$

$R_T = 1/1.35 = .74$ ohm

4. Two volts, since the voltage across each path is the same as the applied voltage.

5. The currents will be the same since the resistance are the same.

6 & 7.



INSTRUCTOR'S FINAL CHECKLIST

WORK WITH PARALLEL CIRCUITS

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

While working with a parallel circuit the student:

	FULLY AC	NOT AC	NOT AP
1. Selected the proper materials.			
2. Constructed the circuit properly.			
3. Used the meter to measure circuit resistance properly.			
4. Used the meter to measure circuit voltage properly.			
5. Used the meter to measure circuit current properly.			
6. Recorded the measured values correctly.			
7. Performed all tasks in a safe manner.			

INSTRUCTOR'S GUIDE SHEET

WORK WITH COMBINATION CIRCUITS

OBJECTIVE

Your instructor will provide you with the necessary materials to construct the circuit and use a meter to accurately measure the resistance, voltage, and current values of the circuit. You will be rated according to the instructor's final checklist.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

You will demonstrate your knowledge of combination circuits by reading with a meter to predetermined value.

CONTENTS	LEARNING ACTIVITY #
Student Self-Check I	3
Instruction Sheet I	4
Instructor's Final Checklist	6

CHECK-OUT ACTIVITY

Given a combination electrical circuit and a VOM, measure the resistance, voltage, and current values in the circuit. Readings must agree with predetermined values.

REFERENCES

Whirlpool Corporation, Basic Electricity for Appliances, Whirlpool Corporation, Benton Harbor, MI.

TASK ASSIGNMENT SHEET APR-014

INSTRUCTOR'S GUIDE SHEET

WORK WITH COMBINATION CIRCUITS

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have the student read in a text about combination circuits.	Whirlpool Corporation, Basic Electricity for Appliance, pages 21-22.	
2.	Have the student observe a demonstration of working with combination circuits.		
3.	Have the student complete Student Self-Check I.	Student Self-Check I	
4.	Have the student read Instruction Sheet I.	Instruction Sheet I	
5.	Allow the student to practice working with combination circuits.	See tools and equipment list.	
	Evaluate the student's performance.	Instructor's Final Checklist.	

TOOLS AND EQUIPMENT

VOM, variable D.C. power supply, resistors, connecting wires.

STUDENT SELF-CHECK I

Answer Key

---

1. Total current is the same as current through each series part of a combination circuit.

2. The total current is equal to the sum of the currents through the parallel paths.

3. The sum of the currents through the paths is equal to the current through the series part of the circuit.

4. The applied voltage is equal to the sum of the voltages across the parallel part. (Remember to only use the parallel voltage once, since it is the same across each component.)

5. The voltage across the series part of the circuit subtracted from the source voltage equals the voltage across the parallel part.

6. The sum of these resistances would equal the total resistance of the circuits.

7. Total Series Resistance = 4 Ohms
   Total Parallel Resistance = 2 Ohms --- $\frac{6\ \text{Ohm}}{3\ \text{Paths}}$ or $\frac{1}{R_T} = \frac{1}{6} + \frac{1}{6} + \frac{1}{6}$
   Total Resistance = 6 Ohms --- 4 ohm + 2 ohm
   Total Current = 1 amp --- $\frac{6\ \text{volts}}{6\ \text{ohms}}$
   Voltage Across R_1 = 2 volts --- I X R_1 = 1 amp x 2 ohms
   Voltage Across R_2 = 2 volts --- I X R_2 = 1 amp x 2 ohms
   Voltage Across R_3, R_4, R_5 = 2 volts --- I x Parallel Resistance = 1 amp x 2 ohms

INSTRUCTOR'S FINAL CHECKLIST

WORK WITH COMBINATION CIRCUITS

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

While working with a combination circuit, the student:

	FULLY AC	NOT AC	NOT AP
1. Selected the proper materials.	____	____	____
2. Constructed the circuit properly.	____	____	____
3. Identified the series part of the circuit.	____	____	____
4. Identified the parallel part of the circuit.	____	____	____
5. Used the meter to measure circuit resistance properly.	____	____	____
6. Used the meter to measure circuit voltage properly.	____	____	____
7. Used the meter to measure circuit current properly.	____	____	____
8. Recorded the measured values correctly.	____	____	____
9. Performed all tasks in a safe manner.	____	____	____

INSTRUCTOR'S GUIDE SHEET

WORK WITH RELAYS AND SOLENOIDS

OBJECTIVE

Given necessary diagrams and a VOM, check the operation of a relay and construct a solenoid. Solenoids must be operational. Your performance will be rated according to the instructor's final checklist.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

You will demonstrate your knowledge of the operations of solenoids and relays.

CONTENTS	LEARNING ACTIVITY #
Student Self-Check I "Working With Relays and Solenoids"	3
Instruction Sheet I "Working With Relays and Solenoids"	4 & 5
Instructor's Final Checklist	6

CHECK-OUT ACTIVITY

Your instructor will provide you with the necessary diagrams, a relay, materials to construct a solenoid, and a meter. Use the meter to check the operation of the relay and solenoid.

REFERENCES

Whirlpool Corporation, Basic Electricity For Appliances, Whirlpool Corporation, Benton Harbor, MI.

INSTRUCTOR'S GUIDE SHEET

WORK WITH RELAYS AND SOLENOIDS

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have the student read about relays and solenoids.	Whirlpool Corporation, Basic Electricity for Appliances, pages 57-58 and 121-123.	
2.	Have the student observe a demonstration on relays and solenoids.		
3.	Have the student complete Student Self-Check I.	Student Self-Check I	
4.	Have the student read Instruction Sheet I.	Instruction Sheet I	
5.	Allow the student to practice the techniques from the instruction sheet.	See tools and equipment list.	
6.	Allow the student to complete the check-out activities for this task assignment .	See tools and equipment list.	
	Evaluate the student's performance.	Instructor's Final Checklist	

TOOLS AND EQUIPMENT

VOM, relay (1K ohm), lamp with socket (6 volt), variable DC power supply, resistor (1K ohm), battery (6 volt), connecting wires, wound coil - #24 wire open center, soft iron core (3/4" X 6 "), SPST switch.

STUDENT SELF-CHECK I

Answer Key

---

1. An electromagnetic device which uses a small current to control a larger current; it has a coil which controls its normally open and normally closed contacts.
2. Those that are open when the relay is not on and closed when the relay is energized.
3. Those that are closed when the relay is not on and open when the relay is energized.
4. The amount of current flow through the coil needed to cause the relay to energize.
5. The amount of current flow through the coil needed to cause the relay to de-energize.
6. Electromagnetic devices with moveable cores or plungers made of magnetic material placed inside a coil; the core is moved when the coil is energized.
7. Door chimes, washing machines, to open and close various types of fluid lines; dishwashers; automobile starters; many other applications.

INSTRUCTOR'S FINAL CHECKLIST

WORK WITH RELAYS AND SOLENOIDS

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

While working with relays and solenoids, the student:	FULLY AC	NOT AC	NOT AP
1. Selected the proper materials.	____	____	____
2. Measured voltage properly.	____	____	____
3. Measured current properly.	____	____	____
4. Measured resistance properly.	____	____	____
5. Identified the "coil" terminals of the relay.	____	____	____
6. Identified the "normally-open" contacts of the relay.	____	____	____
7. Identified the "normally-closed" contacts of the relay.	____	____	____
8. Constructed the solenoid properly.	____	____	____
9. Performed all tasks in a safe manner.	____	____	____

INSTRUCTOR'S GUIDE SHEET

CHECK CHARACTERISTICS OF ALTERNATING CURRENT

OBJECTIVE

Your instructor will provide you with an alternating current power supply, a VOM, and the necessary materials. Construct the alternating current circuits shown in the diagrams and make the measurements which demonstrate the characteristics of alternating current electrical energy. You will be rated according to the instructor's final checklist.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

You will demonstrate your knowledge of alternating current by constructing and testing circuits.

CONTENTS	LEARNING ACTIVITY #
Student Self-Check I	3
Instruction Sheet I	4 & 5
Instructor's Final Checklist	6

CHECK-OUT ACTIVITY

Given an alternating current power supply, a VOM, and the necessary materials, make measurements which reveal the characteristics of alternating current. Findings must agree with those of the instructor.

REFERENCES

Whirlpool Corporation, Basic Electricity for Appliances, Whirlpool Corporation, Benton Harbor, MI.

INSTRUCTOR'S GUIDE SHEET

CHECK CHARACTERISTICS OF ALTERNATING CURRENT

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have the student read about characteristics of alternating current.	Whirlpool Corportion, Basic Electricity for Appliances, pages 61-72.	
2.	Have the student observe a demonstration of checking alternating current.		
3.	Have the student complete Student Self-Check I.	Student Self-Check I	
4.	Have the student read Instruction Sheet I.	Instruction Sheet I.	
5.	Allow the student to practice checking alternating current.	See tools and equipment list. Instruction Sheet I.	
6.	Allow the student to complete the check-out activity listed for this task assignment.	See tools and equipment list.	
	Evaluate the student's performance.	Instructor's Final Checklist.	

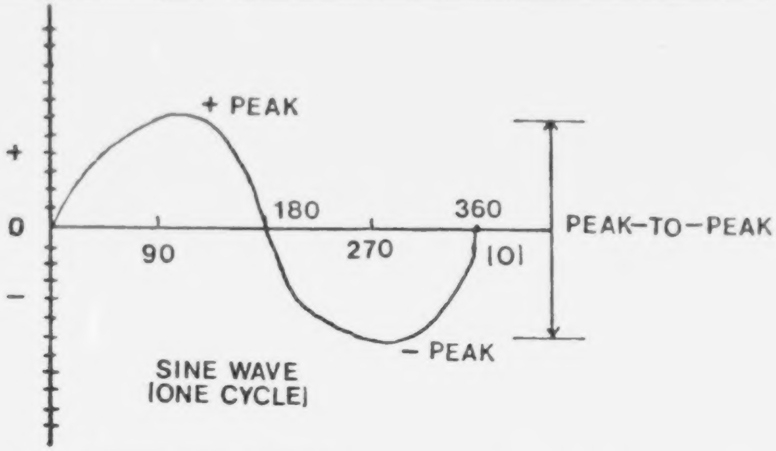
TOOLS AND EQUIPMENT

VOM, variable AC-DC power supply, SPST switch, DPST switch, 6-volt lamp with socket, resistors (10, 22, 33 ohm), connecting wires, 6 volt battery.

STUDENT SELF-CHECK I

Answer Key

1.



2. 60 Hertz or 60 cycles per second.
3. The most common form of electrical energy used in the United States; the direction of current flow changes direction 60 times per second; a cycle of AC or sine wave is shown in the answer to question #1.
4. Since the voltages are the same and the resistance is the same, the power will also be the same.
5. (1) Hertz - cycles per second; unit of measuring frequency.
   (2) Frequency - number of cycles per second.
   (3) Cycle - one sine wave of AC (see answer to question #1).

INSTRUCTOR'S FINAL CHECKLIST

CHECK CHARACTERISTICS OF ALTERNATING CURRENT

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

While developing an understanding of alternating current, the student:

	FULLY AC	NOT AC	NOT AP
1. Selected the proper materials.			
2. Constructed the circuits properly.			
3. Measured AC voltage correctly.			
4. Measured AC current correctly.			
5. Measured resistance correctly.			
6. Calculated values of AC power properly.			
7. Performed all tasks in a safe manner.			

INSTRUCTOR'S GUIDE SHEET

CHECK CAPACITORS

OBJECTIVES

Using the unit provided by your instructor, check the capacitor(s). You will be rated according to the instructor's final checklist.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

You will use an ohmmeter to check capacitors.

CONTENTS	LEARNING ACTIVITY #
Student Self-Check I	3
Instruction Sheet I	4 & 5
Instructor's Final Checklist	6

CHECK-OUT ACTIVITY

Given a unit with a suspected faulty capacitor(s), a volt ohmmeter and the necessary supplies, check capacitor(s). Your analysis should match predetermined findings.

REFERENCES

Doolin, (1976), Doolin's Trouble Shooter's Bible, Doolco Inc., Dallas, TX.

INSTRUCTOR'S GUIDE SHEET

CHECK CAPACITORS

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have the student read about testing capacitors.	Doolin, Doolin's Trouble Shooters Bible, pages 15-17.	
2.	Have the student observe a demonstration on checking capacitors.		
3.	Have the student complete Sudent Self-Check I.	Student Self-Check I.	
4.	Have the student read Instruction Sheet I.	Instruction Sheet I	
5.	Allow the student to practice checking capacitors.	See tools and equipment list.	
6.	Allow the student to complete the check-out activity listed for this task assignment.	See tools and equipment list.	
	Evaluate the student's performance.	Instructor's Final Checklist.	

TOOLS AND EQUIPMENT

Safety glasses, screwdrivers, needlenose pliers, rosin core solder, soldering iron, bleeder resistor, VOM.

STUDENT SELF-CHECK I
Answer Key

---

1. single, two
2. starting, running
3. (a) start, (b) run
4. start
5. voltage, microfarad
6. S
7. R
8. S, R
9. (1) Substitution, (2) Ohmmeter, (3) Expose to voltage and discharge, (4) Capacitor analyzer
10. discharge
11. (1) Shorted (2) Good (3) Open
12. reverse
13. (1) Good (2) Shorted (3) Open
14. shorted, explode

INSTRUCTOR'S FINAL CHECKLIST

CHECK CAPACITORS

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

	FULLY AC	NOT AC	NOT AP
While checking capacitors, the student:			
1. Selected the proper tools and supplies to do the job.			
2. Followed the proper procedure to:			
a. Calibrate his ohmmeter to the proper scale.			
b. Discharge the capacitors before checking.			
c. Disconnecte the proper wires to the capacitor(s) for checking.			
3. Recorded the correct results as per predetermined findings.			
4. Followed the necessary safety precautions.			

INSTRUCTOR'S GUIDE SHEET

SPLICE WIRES

OBJECTIVE

You will mechanically splice, solder, and insulate electrical wiring using materials provided by the instructor. Your performance will be rated according to the instructor's final checklist.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

You will demonstrate your knowledge by splicing, soldering, and insulating electrical wiring.

CONTENTS	LEARNING ACTIVITY #
Instructor's Final Checklist	4

CHECK-OUT ACTIVITY

Provided with wire, tools, and equipment by the instructor, splice wires so the connection does not short, insulation is not frayed, and voltage does not drop across the connectors.

REFERENCES

Meyerink, G., (1973), Appliance Service Handbook, Prentice-Hall, Inc., Englewood Cliffs, NJ.

INSTRUCTOR'S GUIDE SHEET

SPLICE WIRES

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have the student read about wire splices.	Meyerink, Appliance Service Handbook, page 180.	
2.	Have the student observe a demonstration on proper techniques for wire splices.	See tools and equipment list.	
3.	Allow the student to practice making wire splices.	See tools and equipment list.	
4.	Allow the student to complete the check-out activity for this task assignment.	See tools and equipment list.	
	Evaluate the student's performance.	Instructor's Final Checklist	

TOOLS AND EQUIPMENT

VOM, crimp pliers, assorted screwdrivers, needlenose pliers, wire cutters, electrical tape, soft solder, soldering iron.

INSTRUCTOR'S FINAL CHECKLIST

SPLICE WIRES

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.	FULLY AC	NOT AC	NOT AP
In making wire splices, the student performed the following:			
1. Disconnected power.	____	____	____
2. Trimmed ends of wire.	____	____	____
3. Properly connected ends of wires.	____	____	____
4. Insulated splice.	____	____	____
5. Reconnected power and tested for performance.	____	____	____
6. Cleaned work area and stored materials.	____	____	____

INSTRUCTOR'S GUIDE SHEET

WORK WITH SINGLE-PHASE AC INDUCTION

OBJECTIVE

Your instructor will provide you with a single-phase AC induction motor, a meter, and necessary materials. Make the proper measurements to check the operation of the motor. You will be rated according to the instructor's final checklist.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

You will demonstrate your knowledge of single phase, AC induction motors by testing them for proper operation.

CONTENTS	LEARNING ACTIVITY #
Student Self-Check I	3
Instruction Sheet I	4 & 5
Instructor's Final Checklist	6

CHECK-OUT ACTIVITY

Given a single-phase AC induction motor, a meter, and the necessary materials, make the proper measurements to check the operation of the motor. Findings must agree with motor Name/Date Plate.

REFERENCES

Whirlpool Corporation, Basic Electricity for Appliances, Whirlpool Corporation, Benton Harbor, MI.

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INSTRUCTOR'S GUIDE SHEET

WORK WITH SINGLE-PHASE AC INDUCTION MOTORS

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have the student read about induction motors.	Whirlpool Corporation, Basic Electricity for Appliances, pages 99-101 and 105-110.	
2.	Have the student observe a demonstration on working with single-phase AC induction motors.		
3.	Have the student answer the questions from the Student Self-Check I.	Student Self-Check I	
4.	Have the student read Instruction Sheet I.	Instruction Sheet I	
5.	Allow the student to practice working with single-phase AC induction motors.	See tools and equipment list. Instruction Sheet I.	
6.	Allow the student to complete the check-out activity for this task assignment.	See tools and equipment list.	
	Evaluate the student's performance.	Instructor's Final Checklist.	

TOOLS AND EQUIPMENT

AC split-phase induction motor or capacitor-start motor, AC power-source, tachometer, AC ammeter, VOM.

STUDENT SELF-CHECK I

Answer Key

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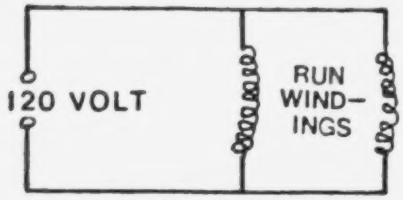
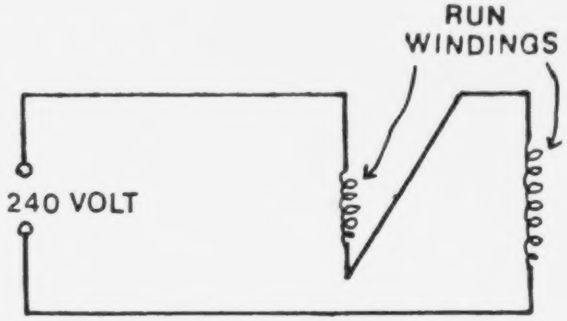
1. The motor has a starting winding and a running winding; the start winding causes the motor to start; the motor has squirrel-cage rotor and operates by induction.

2.



PARALLEL



SERIES

3. $\frac{60 \times 120}{2} = \frac{7200}{2} = 3{,}600$ RPM

4. The run windings are a larger diameter wire.

5. The starting current is higher than the running current.

6. Speed is reduced; current is increased.

7. Reverse the start windings or run winding connections.

INSTRUCTOR'S FINAL CHECKLIST

WORKING WITH SINGLE-PHASE AC INDUCTION MOTORS

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

While working with single-phase AC induction motors, the student:	FULLY AC	NOT AC	NOT AP
1. Selected the proper tools.	____	____	____
2. Identified the motor's start windings.	____	____	____
3. Identified the motor's run windings.	____	____	____
4. Measured starting current properly.	____	____	____
5. Measured running current properly.	____	____	____
6. Loaded the motor correctly.	____	____	____
7. Recorded the motor nameplate data correctly.	____	____	____
8. Reversed the motor's direction of rotation correctly.	____	____	____
9. Performed all tasks in a safe manner.	____	____	____

INSTRUCTOR'S GUIDE SHEET

REPLACE DIGITAL COMPONENT

OBJECTIVE

Given an appliance with a defective digital component in the control circuit by the instructor, you will use the proper tools and service/repair manual and replace the digital component. You will be evaluated according to the Instructor's Final Checklist.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

You will demonstrate your knowledge of digital components by replacing a defective component and checking for correct function.

CONTENTS	LEARNING ACTIVITY #
Instruction Sheet I	3
Instructor's Final Checklist	4

CHECK-OUT ACTIVITY

Your instructor will provide you with an appliance with a digital control circuit, replacement component, the necessary tools, and service/repair manual. You will replace a defective digital component to restore function to meet manufacturer specifications.

REFERENCE

McGraw-Hill, Industrial Electronics & Robotics, Schuler & McNamee, 1986.

Manufacturer's Repair/Service Manual.

INSTRUCTOR'S GUIDE SHEET

REPLACE DIGITAL COMPONENT

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have the student read about digital components	McGraw-Hill, Industrial Electronic & Robotics, Schuler & McNamee, 1986. pp. 308-310	
2.	Have the student observe a demonstration of replacing a digital component.		
3.	Allow the student to practice replacing a digital component.	Instruction Sheet #1	
4.	Allow the student to complete check-out activity.		
	Evaluate the student's performance.	Instructor's Final Checklist	

TOOLS AND EQUIPMENT

Basic electrical repair tool kit, replacement digital component, manufacturer repair/service manual.

INSTRUCTOR'S FINAL CHECKLIST

REPLACE DIGITAL COMPONENT

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In replacing a digital component, the student performed the following:

	FULLY AC	NOT AC	NOT AP
1. Disconnected power supply.			
2. Removed control panel.			
3. Removed defective digital component.			
4. Drained static electricity from body and replacement component.			
5. Installed replacement component.			
6. Reassembled appliance.			
7. Cleaned work area and stored tools.			

INSTRUCTOR'S GUIDE SHEET

USE SOFT SOLDER TO JOIN METAL

OBJECTIVE

Given copper tubing and fittings, soft solder, soldering flux, flux brush, abrasive cloth, file, and a soldering torch -- soft solder copper tubing to a fitting to form a joint. The joint must withstand pressure for systems pressure test after completion. A checklist will be used to rate your performance. All items on the checklist must be fully accomplished.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

You will demonstrate your knowledge of joining metal by soldering fittings to copper tubing.

CONTENTS	LEARNING ACTIVITY #
Student Self-Check I	3
Instructor's Final Checklist	5

CHECK-OUT ACTIVITY

Obtain the proper tubing and fitting from your instructor. Soft solder the copper tubing to the fitting to form a joint. The instructor should observe your work.

REFERENCES

Meyerink, G., (1973), Appliance Service Handbook, Prentice-Hall, Inc., Englewood Cliffs, NJ.

INSTRUCTOR'S GUIDE SHEET

USE SOFT SOLDER TO JOIN METAL

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have the student read about soldering techniques.	Meyerink, Appliance Service Handbook, pages 178-179.	
2.	Have student observe a demonstration of soft soldering techniques.		
3.	Allow the student to complete Student Self-Check I.	Student Self-Check I.	
4.	Allow the student to practice soft soldering techniques.	See tools and equipment list.	
5.	Allow the student to complete the check-out activity for this task assignment.	See tools and equipment list.	
	Evaluate the student's performance.	Instructor's Final Checklist.	

TOOLS AND EQUIPMENT

Cooper tubing and fittings, soft solder, soldering flux, flux brush, abrasive cloth, file, and a soldering torch.

STUDENT SELF-CHECK I
Answer Key

---

1. T
2. F
3. F
4. F
5. F
6. F
7. F
8. F
9. T
10. F

INSTRUCTOR'S FINAL CHECKLIST

USE SOFT SOLDER TO JOIN METAL

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In learning to soft solder, the student:	FULLY AC	NOT AC	NOT AP
1. Wore safety glasses.	____	____	____
2. Removed burrs and fittings.	____	____	____
3. Cleaned tubing and fittings.	____	____	____
4. Partially assembled tubing to fittings.	____	____	____
5. Applied flux to tubing.	____	____	____
6. Heated tubing and fitting until solder flowed into the joint.	____	____	____
7. Tested the joint for leaks.	____	____	____
8. Cleaned the joint.	____	____	____
9. Cleaned work area and stored materials.	____	____	____

INSTRUCTOR'S GUIDE SHEET

LEVEL APPLIANCE CABINET

OBJECTIVE

Level a refrigerator cabinet to manufacturer's specifications. You will be rated according to the instructor's final checklist.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

You will demonstrate your knowledge of levelong appliance cabinets by leveling a refrigerator cabinet.

CONTENTS	LEARNING ACTIVITY #
Instruction Sheet I	2 & 5
Student Self-Check I	4
Instructor's Final Checklist	6

CHECK-OUT ACTIVITY

Given an unlevel refrigerator cabinet, a twelve-inch level and hand tools, you will plumb cabinet. Upon completion, unit must operate and drain within manufacturer's specifications.

REFERENCES

Meyerink, G., (1973), Appliance Service Handbook, Prentice-Hall, Inc., Englewood Cliffs, NJ.

INSTRUCTOR'S GUIDE SHEET

LEVEL APPLIANCE CABINETS

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have the student read about installing appliances.	Meyerink, Appliance Service Handbook, pages 42-44 and 54-55.	
2.	Have the student read Instruction Sheet I.	Instruction Sheet I.	
3.	Have the student observe a demonstration of leveling an appliances.		
4.	Have the student complete leveling an appliance cabinet.	Student Self-Check I	
5.	Allow the student to practice leveling an appliance cabinet	See tools and equipment list. Instruction Sheet I.	
6.	Allow the student to complete the check-out activity listed for this task assignment.	See tools and equipment list.	
	Evaluate the student's performance.	Instructor's Final Checklist.	

TOOLS AND EQUIPMENT

Appliance cabinet, 12" level, rule, crescent wrench.

STUDENT SELF-CHECK I
Answer Key

---

1. To insure proper operation and drainage.
2. To give a level base from which to start the leveling.
3. A spirit level.
4. Adjusting screws and wood shims
5. Front-to-back, side-to-side, top-to-bottom.

INSTRUCTOR'S FINAL CHECKLIST

LEVEL APPLIANCE CABINET

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In learning to level cabinets, the students:

	FULLY AC	NOT AC	NOT AP
1. Used the proper tools.			
2. Leveled the cabinet.			
3. Plumbed the cabinet.			
4. Checked drainage of the cabinet.			
5. Performed all tasks in a safe manner.			

INSTRUCTOR'S GUIDE SHEET

ADJUST DOORS ON REFRIGERATORS AND FREEZERS

OBJECTIVE

Your instructor will provide a refrigerator or freezer cabinet with a maladjusted door and the necessary tools and equipment. Adjust the cabinet door to the manufacturer's specifications. You will be rated according to the instructor's final checklist.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

You will demonstrate your knowledge of adjusting refrigerator and freezer doors by adjusting a refrigerator and/or freezor door.

Student Self-Check I	3
Instruction Sheet I	4 & 5

CHECK-OUT ACTIVITY

Given a refrigerator or freezer cabinet with a maladjusted door and necessary equipment and supplies, adjust the cabinet door. Door must conform to specifications of paper method, 100 watt lamp method, and closing and opening at 25 second interval method upon completion of task.

INSTRUCTOR'S GUIDE SHEET

ADJUST DOORS ON REFRIGERATORS AND FREEZERS

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have the student read about door adjustment.	Instruction Sheet I.	
2.	Have the student observe a demonstration on adjusting refrigerator doors.		
3.	Have the student complete Student Self-Check I.	Student Self-Check I.	
4.	Allow the student to practice making adjustments on a refrigerator door.	See tools and equipment list. Instruction Sheet I.	
5.	Allow the student to complete the check-out activity for this task assignment.	See tools and equipment list.	
	Evaluate the student's performance.	Instructor's Final Checklist	

TOOLS AND EQUIPMENT

Phillips's screwdrivers, nut driver set, shim material, piece of paper.

STUDENT SELF-CHECK I

Answer Key

---

1. For proper operation and efficiency.
2. Across and and in depth.
3. Adjusting door depth.
4. Using a straight edge; level with top and sides.
5. Using a piece of paper between door and jamb; using a light bulb, opening and closing at 25 second intervals.

INSTRUCTOR'S FINAL CHECKLIST

ADJUSTING DOORS ON REFRIGERATORS AND FREEZERS

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.	FULLY AC	NOT AC	NOT AP
In learning how to adjust doors on refrigerator and freezers, the student:			
1. Selected the proper tools.	____	____	____
2. Adjusted door to instructor's specifications.	____	____	____
3. Check alignment.	____	____	____
4. Checked tightness.	____	____	____
5. Performed all tasks in a safe manner.	____	____	____

INSTRUCTOR'S GUIDE SHEET

INSTALL ICE MAKER

OBJECTIVE

Using tools and equipment provided by the instructor, you will install an ice maker in the freezer compartment or a refrigerator. You will be evaluated according to the instructor's final checklist.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

You will demonstrate your ability to install an automatic ice maker.

CONTENTS	LEARNING ACTIVITY #
Instructor's Final Checklist	6

CHECK-OUT ACTIVITY

Given an ice maker, an installation kit, and the necessary tools, install the ice maker in a refrigerator so that it does not leak and tubing is inconspicuous.

REFERENCES

Whirlpool Corporation, Refrigeration II, Whirlpool Corporation, Benton Harbor, MI.

____________, Filmstrip, "Understanding and Servicing the Compact Ice Maker," Whirlpool Corporation, Benton Harbor, MI.

INSTRUCTOR'S GUIDE SHEET

INSTALL ICE MAKER

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have the student read about installing ice makers.	Whirlpool Corporation Refrigeration II, pages 49-71.	
2.	Have the student view filmstrip on ice makers.	Whirlpool Corporation, "Understanding and Servicing the Compact Ice Maker."	
3.	Have the student observe a demonstration on installing a ice maker.	See tools and equipment list.	
4.	Have the student complete the unit test for ice maker installation.	Whirlpool Corporation, Refrigeration II, p. 71.	
5.	Allow the student to practice installing an ice maker.	See tools and equipment list.	
6.	Allow the student to complete the check-out activity for this task assignment.	See tools and equipment list.	
	Evaluate the student's performance according to the instructor's final checklist.	Instructor's Final Checklist.	

TOOLS AND EQUIPMENT

Basic tool kit, tubing cutter, flaring tool, drill/drill bits, extension cord.

INSTRUCTOR'S FINAL CHECKLIST

INSTALL ICE MAKER

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

The student performed the following in installing an ice maker:

	FULLY AC	NOT AC	NOT AP
1. Identified location for ice maker to be installed.			
2. Turned off water supply.			
3. Measured and cut tubing to length for installation.			
4. Ran tubing from refrigerator to water line.			
5. Connected tubing to properly installed saddle valve.			
6. Mounted ice maker in refrigerator.			
7. Tightened all connections.			
8. Turned on water supply and saddle valve, observed for leaks.			
9. Checked operation of ice maker.			
10. Cleaned work area.			

INSTRUCTOR'S GUIDE SHEET

REPAIR FLEX-TRAY ICE MAKER

OBJECTIVE

Given a Flex Tray Ice Maker and the necessary tools by the instructor, you will learn how the Flex-Tray Ice Maker operates and how to disassemble, identify parts, reassemble and check for proper operation. You will be evaluated according to the instructor's final checklist.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

You will demonstrate your knowledge of Flex-Tray Ice Makers by disassembling, identifying parts, reassembling and checking for proper operation.

CONTENTS	LEARNING ACTIVITY #
Student Self-Check I "Repair Flex-Tray Ice Maker"	4
Instructor's Final Checklist	6

CHECK-OUT ACTIVITY

You will troubleshoot, disassemble, and reassemble a Flex Tray Ice Maker. System must operate within manufacturer's specifications with no leaks upon completion of task.

REFERENCES

Training booklet and filmstrip, "The New Flex-Tray Ice Maker," Whirlpool Corporation.

INSTRUCTOR'S GUIDE SHEET

REPAIR FLEX-TRAY ICE MAKER

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have the student read about the Flex-Tray Ice Maker	"The New Flex-Tray Ice Maker," Whirlpool Corporartation.	
2.	Have the student view the filmstrip presentation on the Flex-Tray Ice Maker.	Filmstrip, "The New Flex-Tray Ice Maker," Whirlpool Corporation.	
3.	Have the student observe a demonstration of trouble shooting a Flex-Tray Ice Maker.	See tools and equipment list.	
4.	Have the student complete Student Self-Check I.		
5.	Allow the student to practice troubleshooting a Flex-Tray Ice Maker.	See tools and equipment list.	
6.	Allow the student to perform the check-out activities listed for this task assignment.	See tool and equipment list.	
	Evaluate the student's performance according to the Instructor's Final Checklist.	Instructor's Final Checklist.	

TOOLS AND EQUIPMENT

Basic repair toolkit, Whirlpool refrigerator circuit analyzer.

STUDENT SELF-CHECK I

Answer Key

---

1. E.
2. B
3. B
4. A
5. B
6. C
7. B
8. A
9. Refrigerator will not have operated
10. The ice maker will not operate because the defrost bi-metal will be open.

INSTRUCTOR'S FINAL CHECKLIST

REPAIR FLEX-TRAY ICE MAKER

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

The student performed the following task activities:

	FULLY AC	NOT AC	NOT AP
1. Diassembled the Flex-Tray Icemaker.			
2. Identified the parts of the Flex Tray Icemaker motor, defrost switch, water switch.			
3. Described how the Icemaker works.			
4. Reassembled the Flex Tray Icemaker.			
5. Checked for proper operation.			
6. Performed all activities in a safe manner.			
7. Took test Refrigeration II, Lesson 4.			

INSTRUCTOR'S GUIDE SHEET

REPLACE REFRIGERATOR DEFROSTER HEATING ELEMENT

OBJECTIVE

The instructor will provide an automatic defrost refrigerator, replacement defrost heater, proper tools and manufacturers repair manual. You will remove a defective heater and install a replacement. You will be evaluated according to the instructor's final checklist.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

You will demonstrate your ability to change a defrost heater on an automatic defrost refrigerator.

CONTENTS	LEARNING ACTIVITY #
Instruction Sheet I	3
Instructor's Final Checklist	4

CHECK-OUT ACTIVITY

Your instructor will provide an automatic defrost refrigerator, a replacement defrost heater, proper tools, and a manufacturers repair manual. You will install the replacement heater so that the refrigerator operates at manufacturers specifications.

REFERENCES

Manufacturer's Repair Manual

INSTRUCTOR'S GUIDE SHEET

REPLACE REFRIGERATOR DEFROSTER HEATING ELEMENT

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have the student read about defrost heaters on automatic defrost refrigerators.	Manufacturer Repair Manual	
2.	Have student observe a presentation on defrost heater replacement.		
3.	Have student practice replacing defrost heater.	Manufacturer Repair Manual	
4.	Allow student to complete check-out activity listed on this task assignment.		
5.	Evaluate student performance.	Instructor's Final Checklist	

TOOLS AND EQUIPMENT

Basic appliance repair tool kit, replacement defrost heater, and service manual.

INSTRUCTOR'S FINAL CHECKLIST

REPLACE REFRIGERATOR DEFROSTER HEATING ELEMENT

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In replacing the refrigerator defroster heating element, the student performed the following:

	FULLY AC	NOT AC	NOT AF
1. Disconnected power supply.			
2. Removed heater and installed replacement.			
3. Reassembled refrigerator and reconnected power supply.			
4. Cleaned up area and stored tools.			

INSTRUCTOR'S GUIDE SHEET

SERVICE ELECTRIC MOTORS

OBJECTIVE

Your instructor will provide you with a volt-ohmmeter, ampere meter, and other necessary equipment and supplies. The instructor will provide a performance guide for servicing an electric motor. You must then service the motor provided. Your performance will be rated according to the instructor's final checklist.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

You will demonstrate your knowledge of electric motor service procedures by servicing an electric motor.

CONTENTS	LEARNING ACTIVITY #
Instruction Sheet I	3 & 4
Student Self-Check I	5
Instructor's Final Checklist	6

CHECK-OUT ACTIVITY

Given a motor, a volt-ohmmeter, an ampere meter, and other necessary equipment and supplies, service the motor according to preventive maintenance specifications.

REFERENCES

Meyerink, G., (1973), Appliance Service Handbook, Prentice-Hall, Inc., Englewood Cliffs, NJ.

INSTRUCTOR'S GUIDE SHEET

SERVICE ELECTRIC MOTORS

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have the student read about servicing electric motors.	Meyerink, Appliance Service Handbook, pages 88-93.	
2.	Have the student observe a demonstration of the procedures to use in servicing an electric motor.		
3.	Have the student read Instruction Sheet I.	Instruction Sheet I.	
4.	Allow the student to practice servicing an electric motor.	See tools and equipment list. Instruction Sheet I.	
5.	Have the student complete Student Self-Check I.	Student Self Check I.	
6.	Allow the student to complete the check-out activity listed for this task assignment.	See tools and equipment list.	
	Evaluate the student's performance.	Instructor's Final Checklist.	

TOOLS AND EQUIPMENT

VOM, bleeder resistor, assorted open-end wrenches, screwdrivers, Allen wrenchs, compressed air supply, oil, ampere meter.

STUDENT SELF-CHECK I

Answer Key

---

1. Power disconnected
2. Motor
3. Adjustable or non-adjustable
4. Amp draw
5. Discharged
6. Oil, grease

INSTRUCTOR'S FINAL CHECKLIST

SERVICE ELECTRIC MOTORS

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

While servicing an electric motor, the student:	FULLY AC	NOT AC	NOT AP
1. Selected the proper tools.			
2. Disconnected power.			
3. Removed belt.			
4. Discharged capacitor (if it is a capacitor motor).			
5. Cleaned motor with brush and vacuum cleaner or air pressure.			
6. Checked motor shaft for up and down movement and end play.			
7. Checked for free spin.			
8. Lubricated motor and checked for cleanliness loose set screw and pulley alignment.			
9. Checked and recorded information on motor data plate.			
10. Replaced belt.			
11. Operated motor and checked voltage and amps.			
12. Performed all tasks in a safe manner.			

INSTRUCTOR'S GUIDE SHEET

INSTALL ELECTRIC RANGE

OBJECTIVE

Given an electric range, access to electrical tools and materials by the instructor, you will install an electric range according to the manufacturer's specifications. You will be rated according to the instructor's final checklist.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

You will demonstrate your ability to install an electric range.

CONTENTS	LEARNING ACTIVITY #
Instructor's Final Checklist "Install Electric Range"	5

CHECK-OUT ACTIVITY

Install an electric range and check range under normal load conditions for correct operation. When installed, indicator lights will illuminate, heating elements heat in various "on" positions and cease to heat when turned off.

RECOMMENDED REFERENCES

Whirlpool Corporation, Electric Ranges, Whirlpool Corporation, Benton Harbor, MI.

INSTRUCTOR'S GUIDE SHEET

INSTALL ELECTRIC RANGE

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have the student read about electric range installation	Whirlpool Corporation Electric Range	
2.	Have the student read the range manufacturer's installation instructions	Manufacturer's installation instruction	
3.	Have the student observe a demonstration on installing an electric range		
4.	Allow the student to practice installing an electric range	See tools and equipment list	
5.	Allow the student to perform the check-out activity listed	See tools and equipment list	
	Evaluate the student's performance according instructor's final checklist.	Instructor's Final Checklist	

TOOLS AND EQUIPMENT

Basic electrical repair hand tool kit, volt-ohm meter, level.

INSTRUCTOR'S FINAL CHECKLIST

INSTALL ELECTRIC RANGE

	FULLY AC	NOT AC	NOT AF
Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.			
In installing an electric range the student performed the following:			
1. Gathered necessary tools for installing electric range.	____	____	____
2. Uncrated the electric range.	____	____	____
3. Read manufacturer's installation instructions.	____	____	____
4. Installed the electric range and leveled.	____	____	____
5. Checked range for proper operation.	____	____	____
6. Checked and stored all materials.	____	____	____

INSTRUCTOR'S GUIDE SHEET

REPLACE A SURFACE UNIT ON AN ELECTRIC RANGE

OBJECTIVE

Given an electric range, test equipment, hand tools, and a replacement surface unit by the instructor, you will replace a defective surface unit on an electric range. You will be evaluated according to the instructor's final checklist.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

You will demonstrate your ability to replace a defective surface unit on an electric range.

CONTENTS	LEARNING ACTIVITY #
Instruction Sheet I "Replace a Surface Unit on an Electric Range"	3
Instructor's Final Checklist "Replace a Surface Unit on an Electric Range"	4

CHECK-OUT ACTIVITY

You will replace a defective surface heating unit on an electric range with a new unit. The replacement will operate to the manufacturer's original specifications.

RECOMMENDED REFERENCES

Whirlpool Corporation, Range Service, Whirlpool Corporation, Benton Harbor, MI.

INSTRUCTOR'S GUIDE SHEET

REPLACE A SURFACE UNIT ON AN ELECTRIC RANGE

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have the student read about surface element operation and replacement	Whirlpool Corporation, Range Service, pp. 24-26.	
2.	Have the student observe demonstration on replacing a range surface unit.		
3.	Allow the student to practice surface unit replacement	Instruction Sheet I See tools and equipment list	
4.	Allow the student to complete the check-out activity	See tools and equipment list	
	Evaluate the student's performance according to the instructor's final checklist	Instructor's Final Checklist	

TOOLS AND EQUIPMENT

Basic electrical repair tool kit, VOM, replacement surface unit.

INSTRUCTOR'S FINAL CHECKLIST

REPLACE A SURFACE UNIT ON AN ELECTRIC RANGE

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In replacing a range surface unit, the student performed the following:

	FULLY AC	NOT AC	NOT AP
1. Gathered necessary tools and equipment.	____	____	____
2. Safely removed and replaced defective surface unit.	____	____	____
3. Tested unit for proper operation after repair.	____	____	____
4. Cleaned work area and stored materials in proper place.	____	____	____

INSTRUCTOR'S GUIDE SHEET

TROUBLESHOOT AN ELECTRIC RANGE

OBJECTIVE

Given a variety of problems that would affect the operation and performance of an electric range. You will discuss in writing the usual causes of the problem. You will be evaluated according to the instructor's final checklist.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

You will demonstrate your knowledge of troubleshooting an electric range by listing probable causes and repair procedures for a number of common problems with an electric range.

CONTENTS	LEARNING ACTIVITY #
Student Self Check I "Troubleshoot an Electric Range"	1
Instructor's Final Checklist "Troubleshoot an Electric Range"	4

CHECK-OUT ACTIVITY

You will answer, in writing, the usual cause of commonly reported problems of electric ranges. The action to repair the problem must be described for the problems listed in Student Self Check I.

RECOMMENDED REFERENCES

Whirlpool Corporation, Range Service, Whirlpool Corporation, Benton Harbor, MI.

INSTRUCTOR'S GUIDE SHEET

TROUBLESHOOT AN ELECTRIC RANGE

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have the student read about troubleshooting an electric range.	Whirlpool Corporation, Range Service, pp. 45-78	
2.	Have the student observe the procedures used to troubleshoot a range		
3.	Allow the student to discuss the techniques of troubleshooting a range		
4.	Allow the student to complete the listed check-out activity.	Student Self Check I	
	Evaluate the student according to the instructor's final checklist.	Instructor's Final Checklist	

INSTRUCTOR'S FINAL CHECKLIST

TROUBLESHOOT AN ELECTRIC RANGE

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In troubleshooting an electric range, the student performed the following:

	FULLY AC	NOT AC	NOT AP
1. Read assigned material.	_____	_____	_____
2. Completed Student Self Check I in allotted time.	_____	_____	_____
3. Demonstrated ability to repair or replace defective parts on an electric range (if available).	_____	_____	_____
4. Checked range for proper operation.	_____	_____	_____

INSTRUCTOR'S GUIDE SHEET

REPLACE ELECTRIC RANGE BALLAST TRANSFORMER

OBJECTIVE

Given an electric range, test instruments, hand tools, and a replacement ballast by the instructor, you will remove the defective ballast transformer and install a replacement. You will be rated according to the instructor's final checklist.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

You will demonstrate your ability to replace an electric range ballast transformer.

CONTENTS	LEARNING ACTIVITY #
Instruction Sheet I "Replace Electric Range Ballast Transformer"	4
Instructor's Final Checklist	6

CHECK-OUT ACTIVITY

You will remove a defective ballast transformer from an electric range and install a replacement to meet manufacturer's specifications.

RECOMMENDED REFERENCES

Whirlpool Corporation, Basic Electricity for Appliances, Whirlpool Corporation, Benton Harbor, MI.

INSTRUCTOR'S GUIDE SHEET

REPLACE ELECTRIC RANGE BALLAST TRANSFORMER

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have the student read about ballast transformers	Whirlpool Corporation, Basic Electricity for Appliances, pp. 143-151	
2.	Have the student observe a demonstration on replacing ballast transformers		
3.	Have the student complete the unit test in writing	Whirlpool Corporation, Basic Electricity for Appliances, Lesson 13 test	
4.	Allow the student to practice replacing a ballast transformer	Instruction Sheet I See tools and equipment list	
5.	Allow the student to complete the check-out activity	See tools and equipment list	
	Evaluate the student's performance according to the instructor's final checklist	Instructor's Final Checklist	

TOOLS AND EQUIPMENT

Basic electrical repair hand tool kit, volt-ohm meter, replacement ballast transformer.

INSTRUCTOR'S FINAL CHECKLIST

REPLACE ELECTRIC RANGE BALLAST TRANSFORMER

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In replacing a ballast transformer, the student performed the following:

	FULLY AC	NOT AC	NOT AP
1. Disconnected power source.			
2. Removed back cover from range.			
3. Removed defective ballast transformer.			
4. Installed correct replacement ballast transformer.			
5. Replaced back cover.			
6. Restored power.			
7. Checked for proper operation.			

INSTRUCTOR'S GUIDE SHEET

REPLACE AN ELECTRIC RANGE CLOCK/TIMER

OBJECTIVE

The instructor will provide an electric range, test instruments, electric hand tools, a service manual, and a replacement timer. You will remove the timer from the range and replace it with a new timer. The timer function of the range must operate within the manufacturer's specifications.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

You will demonstrate your ability to replace an electric range clock/timer.

CONTENTS	LEARNING ACTIVITY #
Instruction Sheet I "Replacing a Range Clock-Timer"	3
Instructor's Final Checklist "Replace an Electric Range Clock-Timer"	4

CHECK-OUT ACTIVITY

Given a defective clock-timer and the necessary tools and equipment, replace the clock-timer with a new unit so that it operates within the manufacturer's specification.

RECOMMENDED REFERENCES

Whirlpool Corporation, Range Service, Whirlpool Corporation, Benton Harbor, MI.

INSTRUCTOR'S GUIDE SHEET

REPLACE AN ELECTRIC RANGE CLOCK/TIMER

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have the student read about replacing a clock-timer	Whirlpool Corporation, Range Service, pp. 30-31	
2.	Have the student observe a demonstration of clock-timer replacement		
3.	Allow the student to practice replacing a clock-timer unit.	Instruction Sheet 1 See tools and equipment list	
4.	Allow the student to complete the check-out activity for this task assignment	See tools and equipment list	
	Evaluate the student's performance using the instructor's final checklist	Instructor's Final Checklist	

TOOLS AND EQUIPMENT

Basic electrical repair tool kit, VOM, soldering iron, acid-core solder, heat resistant cloth.

INSTRUCTOR'S FINAL CHECKLIST

REPLACE A ELECTRIC RANGE CLOCK-TIMER

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In replacing a clock-timer the student performed the following:

	FULLY AC	NOT AC	NOT AP
1. Disconnected power supply.			
2. Removed back cover from range.			
3. Removed control knobs from timer.			
4. Disconnected wiring from timer and removed timer.			
5. Mounted new timer in range.			
6. Reconnected wiring and replaced control knobs.			
7. Installed back cover.			
8. Restored power and checked timer operation.			
9. Cleaned work area.			

INSTRUCTOR'S GUIDE SHEET

REPLACE ELECTRIC RANGE OVEN THERMOSTAT

OBJECTIVES

The instructor will provide an electric range, proper tools, and a replacement oven thermostat. You will replace the thermostat and check for proper operation. You will be evaluated according to the instructor's final checklist.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

You will demonstrate your ability to replace an oven thermostat on an electric range.

CONTENTS	LEARNING ACTIVITY #
Student Self Check I	4
Instructor's Final Checklist	4

CHECK-OUT ACTIVITIES

Given an electric range with a defective oven thermostat, proper tools, and a replacement thermostat, you will replace the thermostat so that one range oven operates at manufacturer's specifications.

REFERENCES

Meyerick, Appliance Service Handbook, pp. 331-344.
Whirlpool Service Booklet, "Range," pp. 11-26, 24-39.

INSTRUCTOR'S GUIDE SHEET

REPLACE ELECTRIC RANGE OVEN THERMOSTAT

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have the student read about replacing electric range oven thermostats.	Meyerink, Appliance Service Handbook, pp. 331-344. Whirlpool Service Booklet, "Range," pp. 11-26, 27-39.	
2.	Have the student observe a demonstration on how to replace an electric range oven thermostat.		
3.	Allow the student to practice replacing an electric range oven thermostat.	See tools and equipment list	
4.	Allow the student to complete the check-out activities for this task assignment.	Student Self-Check I	
	Evaluate the student's performance using the instructor's final checklist.	Instructor's Final Check-list	

TOOLS AND EQUIPMENT

Basic electrical repair tool kit, VOM, and replacement thermostat.

INSTRUCTOR'S FINAL CHECKLIST

REPLACE ELECTRIC RANGE OVEN THERMOSTAT

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

	FULLY AC	NOT AC	NOT AP
1. Gathered necessary tools an equipment.			
2. Replaced the oven thermostat.			
3. Tested for proper operation.			
4. Described why part was replaced.			
5. Cleaned and stored all materials in proper place.			
6. Took test, Chapter 2 and 3, Range.			

INSTRUCTOR'S GUIDE SHEET

INSTALL GARBAGE DISPOSER

OBJECTIVE

Given a garbage disposer and the necessary tool and equipment by the instructor, you will install the disposer. The disposer must operate to the manufacturer's specifications. You will be rated according to the instructor's final checklist.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

You will demonstrate your ability to install a garbage disposal unit.

CONTENTS	LEARNING ACTIVITY #
Instructor's Final Checklist	5

CHECK-OUT ACTIVITY

You will install a garbage disposal unit in a kitchen sink using materials and tools furnished by your instructor. The disposal must operate within the manufacturer's specifications with no water leaks in the plumbing connections.

REFERENCES

Meyerink, G., (173), Appliance Service Handbook, Prentice-Hall, Inc., Englewood Cliffs, NJ.

INSTRUCTOR'S GUIDE SHEET

INSTALL GARBAGE DISPOSAL UNIT

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have the student read about installing a garbage disposal unit.	Meyerink, Appliance Service Handbook, pages 50-51.	
2.	Have the student observe a demonstration on installing a garbage disposal unit.		
3.	Have the student answer in writing the questions on disposal installation.	Meyerink, Appliance Service Handbook page 51.	
4.	Allow the student to practice installing a garbage disposal unit.	See tools and equipment list.	
5.	Allow the student to complete the check-out activity for this task assignment.	See tools and equipment list.	
	Evaluate the student's performance.	Instructor's Final Checklist.	

TOOLS AND EQUIPMENT

Basic appliance service tool kit, electrical wire (#12), plumbing fittings, plumber's putty.

INSTRUCTOR'S FINAL CHECKLIST

INSTALL GARBAGE DISPOSAL UNIT

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In learning to install a garbage disposal, unit the student performed the following:

	FULLY AC	NOT AC	NOT AP
1. Installed flange-mount in sink.			
2. Mounted disposal unit on flange-mount.			
3. Connected disposal outlet to sink drain trap.			
4. Connected disposal to electric power supply.			
5. Tested disposal for proper operation with no leaks.			
6. Cleaned work area and stored tools and materials.			

INSTRUCTOR'S GUIDE SHEET

INSTALL AN ELECTRIC CLOTHES DRYER

OBJECTIVE

Given an electric, automatic clothes dryer, electrical cable, and tools and materials by the instructor, you will install an electric, automatic clothes dryer. You will be evaluated according to the instructor's final checklist.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

You will demonstrate your ability to install an electric, automatic clothes dryer.

Instruction Sheet I "Install an Electric Automatic Clothes Dryer"	4
Instructor's Final Checklist "Install an Electric Automatic Clothes Dryer"	5

CHECK-OUT ACTIVITY

The instructor will provide an automatic clothes dryer, tools, and equipment. You will install the dryer to the manufacturer's specifications.

REFERENCES

Whirlpool Corporation, Delivery, Handling, and Installation of Whirlpool Laundry Products, Whirlpool Corporation, Benton Harbor, MI.

INSTRUCTOR'S GUIDE SHEET

INSTALL AN ELECTRIC CLOTHES DRYER

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have the student read about dryer installation	Whirlpool Corporation Delivery, Handling, and Installation of Whirlpool Laundry Products.	
2.	Have the student read the manufacturer's installation instructions.	Dryer installation instructions.	
3.	Have the student observe the installation of an electric automatic clothes dryer.	See tools and equipment list.	
4.	Allow the student to practice installing an electric automatic dryer.	Instruction Sheet I See tools and equipment list.	
5.	Allow the student to complete the check-out activity.	See tools and equipment list.	
	Evaluate the student according to the final checklist.	Instructor's Final Checklist.	

TOOLS AND EQUIPMENT

Basic electrical tool kit, tin snips, masonry chisel, spirit level, VOM, electrical cable, flexible duct hose.

INSTRUCTOR'S FINAL CHECKLIST

INSTALL AN ELECTRIC, AUTOMATIC CLOTHES DRYER

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In installing an electric, automatic clothes dryer, the student performed the following:

	FULLY AC	NOT AC	NOT AP
1. Selected proper location to install dryer.			
2. Provided power source and outside vent.			
3. Uncrated dryer without damage.			
4. Read installation instructions.			
5. Installed unit with proper vent and electrical connections.			
6. Checked dryer for proper operation.			
7. Cleaned work area and stored tools.			

INSTRUCTOR'S GUIDE SHEET

READING WIRING DIAGRAMS FOR ELECTRIC CLOTHES DRYERS

OBJECTIVE

Using material provided by the instructor, you will study the wiring diagrams of an electric clothes dryer and diagnose problems in the electrical circuits. You will recognize symbols used in electrical diagrams quickly and accurately. Troubleshooting should begin with a visual inspection and observing machine operation.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

You will demonstrate your knowledge of wiring diagrams for electric clothes dryers by diagnosing problems in the electrical circuits.

CONTENTS	LEARNING ACTIVITY #
Instruction Sheet I Reading Wiring Diagrams for Electric Clothes Dryers	3 & 4

CHECK-OUT ACTIVITY

Your instructor will provide a clothes dryer and wiring diagrams. You will interpret the wiring diagram and compare it with the dryer's electrical circuits. You will complete the unit test on wiring diagrams with a score of 85% or higher.

REFERENCES

Whirlpool Corp., Basic Electricity for Appliances, Benton Harbor, MI.

Myerink, Appliance Service Handbook, Prentice-Hall, Inc.

INSTRUCTOR'S GUIDE SHEET

READING WIRING DIAGRAMS FOR ELECTRIC CLOTHES DRYERS

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have student read about electric dryer wiring diagrams.	Whirlpool Coporation Basic Electricity for Appliances, p. 23. Meyerink, Appliance Service Handbook pp. 269-270.	
2.	Have student observe a presentation on wiring diagram symbols.	Instruction Sheet I	
3.	Have student practice identify wiring diagram symbols.	Instruction Sheet I	
4.	Have student compare the wiring diagram with the dryer's electrical circuits.	Manufacturer's Wiring Diagram	
5.	Allow student to complete check-out activity listed for this task assignment.	Manufacturer's Wiring Diagram	
6.	Evaluate student's performance.	Instructor's Final Checklist	

TOOLS AND EQUIPMENT

Basic appliance repair tool kit, manufacturer's wiring diagrams and service manu

INSTRUCTOR'S FINAL CHECKLIST

READING WIRING DIAGRAMS FOR ELECTRIC CLOTHES DRYERS

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In applying electric clothes dryer wiring diagrams to electric circuits, the student performed the following:	FULLY AC	NOT AC	NOT AP
1. Read the material on wiring diagrams.	_____	_____	_____
2. Identified wiring diagram symbols correctly.	_____	_____	_____
3. Checked wiring diagrams against electrical circuits.	_____	_____	_____
4. Completed unit test with score of 85% or higher.	_____	_____	_____

INSTRUCTOR'S GUIDE SHEET

REPLACE ELECTRIC DRYER SERVICE CORD

OBJECTIVE

Given a clothes dryer, tools, and a replacement service cord by the instructor, you will replace the service cord to restore proper operation. You will be rated according to the instructor's final checklist.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

You will demonstrate your ability to replace an electric dryer service cord.

CONTENTS	LEARNING ACTIVITY #
Instructor's Final Checklist "Replace Electric Dryer Service Cord"	5

CHECK-OUT ACTIVITY

The instructor will provide an electric clothes dryer, tools, a new service cord, and a service manual. You will remove the old service cord and replace it with a new service cord. The dryer will operate to proper specifications.

REFERENCES

Whirlpool Corporation, Automatic Dryers, Whirlpool Corporation, Benton Harbor, MI.

INSTRUCTOR'S GUIDE SHEET

REPLACE ELECTRIC DRYER SERVICE CORD

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have the student read about service cords.	Whirlpool Corporation Automatic Dryers, pp. 10-12.	
2.	Have the student view the film on laundry products.	Whirlpool Corporation, "Delivery, Handling, and Installation of Whirlpool Laundry Products".	
3.	Have the student observe a demonstration on replacing a dryer service cord.	See tools and equipment list.	
4.	Allow the student to practice replacing a service cord.	See tools and equipment list.	
5.	Allow the student to complete the check-out activity listed.	See tools and equipment list.	
	Evaluate the student's performance according to the instructor's final checklist.	Instructor's Final Checklist.	

TOOLS AND EQUIPMENT

Basic electrical repair tool kit, replacement service cord.

INSTRUCTOR'S FINAL CHECKLIST

REPLACE ELECTRIC DRYER SERVICE CORD

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In replacing a service cord, the student performed the following:

	FULLY AC	NOT AC	NOT AP
1. Disconnected dryer from power supply.			
2. Examined service cord for damage.			
3. Selected proper replacement service cord.			
4. Removed and replaced service cord.			
5. Reconnected dryer and checked operations.			
6. Cleaned work area and stored tools.			

INSTRUCTOR'S GUIDE SHEET

REPALCE ELECTRIC DRYER HEATING ELEMENT

OBJECTIVE

The instructor will provide an electric clothes dryer, test instruments, tools, and replacement heating element. You will remove a defective heating element and install a replacement so that the dryer operates at the manufacturer's specification. You will be rated according to the instructor's final checklist.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

You will demonstrate your ability to replace an electric dryer heating element.

CONTENT	LEARNING ACTIVITY #
Instruction Sheet I "Replace Electric Dryer Heating Element"	4
Instructor's Final Checklist "Replace Electric Dryer Heating Element"	5

CHECK-OUT ACTIVITY

You will remove a defective heating element and install a replacement on an electric clothes dryer provided by your instructor.

REFERENCES

Whirlpool Corporation, Automatic Dryers, Whirlpool Corporation, Benton Harbor, MI.

"Service Procedures for Mechanical Systems," Whirlpool Corporation, Benton Harbor, MI.

INSTRUCTOR'S GUIDE SHEET

REPLACE ELECTRIC DRYER HEATING ELEMENT

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have the student read about heating elements.	Whirlpool Corporation, Automatic Dryers, pp. 49-53.	
2.	Have the student view a film on dryer heaters.	Whirlpool Corporation, "Service Procedures for Mechanical Systems."	
3.	Have the student observe a demonstration on replacing a heating element.		
4.	Allow the student to practice replacing a dryer heating element.	Instruction Sheet I See tools and equipment list.	
5.	Allow the student to complete the check-out activity listed.	See tools and equipment list.	
	Evaluate the student's performance according to the instructor's final checklist.	Instructor's Final Checklist.	

TOOLS AND EQUIPMENT

Basic electrical repair tool kit, VOM, service manual, replacement heating element.

INSTRUCTOR'S FINAL CHECKLIST

REPLACE ELECTRIC DRYER HEATING ELEMENT

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In replacing an electric clothes dryer heating element, the student performed the following:

	FULLY AC	NOT AC	NOT AP
1. Disconnected power.			
2. Removed dryer back panel.			
3. Removed heating element shield.			
4. Removed and replaced heating element.			
5. Installed element shield and back panel.			
6. Tested dryer for proper operations.			
7. Cleaned work area and returned tools to storage			

INSTRUCTOR'S GUIDE SHEET

REPLACE ELECTRIC DRYER TEMPERATURE CONTORL

OBJECTIVE

You will remove and replace the temperature control on an electric clothes dryer using tools, test instruments, and replacement temperature control furnished by the instructor. You will be evaluated according to the instructor's final checklist.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

You will demonstrate your ability to replace temperature control devices on an electric dryer.

CONTENTS	LEARNING ACTIVITY #
Instruction Sheet I "Replace Electric Dryer Temperature Control"	3
Instructor's Final Checklist "Replace Electric Dryer Temperature Control"	4

CHECK-OUT ACTIVITY

Your instructor will provide you with a clothes dryer, a new temperature control, and tools. Install the new temperature control so that the dryer operates to manuafacturer's specifications.

REFERENCES

Whirlpool Corporation, Automatic Dryers, Whirlpool Corporation, Benton Harbor, MI.

INSTRUCTOR'S GUIDE SHEET

REPLACE ELECTRIC DRYER TEMPERATURE CONTROL

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have the student read about dryer temperature controls.	Whirlpool Corporation, Automatic Dryers, pp. 99-105.	
2.	Have the student observe a demonstration on replacing a dryer temperature control.		
3.	Allow the student to practice replacing a dryer temperature control.	Instruction Sheet I See tools and equipment list.	
4.	Allow the student to complete the check-out activity.	See tools and equipment list.	
	Evaluate students performance according to to the instructor's final checklist.	Instructor's Final Checklist.	

INSTRUCTOR'S FINAL CHECKLIST

REPLACE ELECTRIC DRYER TEMPERATURE CONTROL

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In replacing a temperature control unit, the student performed the following:

	FULLY AC	NOT AC	NOT AP
1. Removed panels for access.			
2. Removed mounting fixtures.			
3. Removed sensing tube and electrical terminals.			
4. Installed new thermostat and control.			
5. Reassembled the unit.			
6. Connected power supply and checked operation.			

INSTRUCTOR'S GUIDE SHEET

REPLACE ELECTRIC DRYER DRIVE BELT

OBJECTIVE

The instructor will provide an electric clothes dryer, replacement belt, proper tools, and manufacturer's service manual. You will remove a defective belt and install a replacement belt on electric clothes dryer. You will be evaluated according to the instructor's final checklist.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

You will demonstrate your ability to replace a drive belt on an electric dryer.

CONTENTS	LEARNING ACTIVITY #
Instruction Sheet I	3
Instructor's Final Checklist	4

CHECK-OUT ACTIVITY

Your instructor will provide an electric clothes dryer, a replacement belt, proper tools and a manufacturer's service manual. You will install the replacement belt so that the dryer operates at manufacturer's specifications.

REFERENCES

Manufacturer's Service Manual.

INSTRUCTOR'S GUIDE SHEET

REPLACE ELECTRIC DRYER DRIVE BELT

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have student read about Electric Clothes Dryer Belt.	Manufacturer's Repair Manual	
2.	Have student observe a presentation on belt replacement.		
3.	Have student practice replacing Electric Clothes Dryer Belt.	Manufacturer's Repair Manual	
4.	Allow student to complete check-out activity listed on this task assignment.		
5.	Evaluate student performance.	Instructor's Final Checklist.	

TOOLS AND EQUIPMENT

Basic appliance repair tool kit, replacement belt, and service handbook.

INSTRUCTOR'S FINAL CHECKLIST

REPLACE ELECTRIC DRYER DRIVE BELT

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

	FULLY AC	NOT AC	NOT AP
In replacing the electric clothes dryer belt, the student performed the following:			
1. Disconnected power supply.	_____	_____	_____
2. Inspected belt for wear/damage.	_____	_____	_____
3. Removed old belt and installed new one.	_____	_____	_____
4. Reconnected power supply.	_____	_____	_____
5. Checked dryer operation.	_____	_____	_____
6. Cleaned work area and stored tools.	_____	_____	_____

INSTRUCTOR'S GUIDE SHEET

REPLACE DRYER MOTOR CAPACITOR

OBJECTIVE

Given an automatic clothes dryer, test instruments, electrical hand tools, replacement capacitor, and service manual by the instructor, you will replace a defective motor capacitor. You will be rated according to the instructor's final checklist.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

You will demonstrate your ability to replace a defective motor capacitor in an automatic clothes dryer.

CONTENTS	LEARNING ACTIVITY #
Instruction Sheet I "Replace Dryer Motor Capacitor"	3
Instructor's Final Checklist "Replace Dryer Motor Capacitor"	4

CHECK-OUT ACTIVITY

Provided a defective capacitor and the necessary tools, you will replace the capacitor so that all electrical connections are secure and the motor starts and runs according to the manufacturer's specifications.

REFERENCE

Whirlpool Corporation, Automatic Dryers, Whirlpool Corporation, Benton Harbor, MI.

INSTRUCTOR'S GUIDE SHEET

REPLACE DRYER MOTOR CAPACITOR

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have the student read about motor capacitors	Whirlpool Corporation Automatic Dryers, pp. 38-46 and p. 131.	
2.	Have the student observe a demonstration of replacing a dryer motor capacitor.		
3.	Allow the student to practice replacing a dryer motor capacitor	Instruction Sheet I See tools and equipment list.	
4.	Allow the student to complete the check-out activity listed.		
	Evaluate the student's performance according to the instructor's final checklist.		

TOOLS AND EQUIPMENT

Basic electrical repair tool kit, VOM, service manual, replacement capacitor.

INSTRUCTOR'S FINAL CHECKLIST

REPLACE DRYER MOTOR CAPACITOR

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In replacing a dryer motor capacitor, the student performed the following:

	FULLY AC	NOT AC	NOT AP
1. Determined capacitor replacement was required.	____	____	____
2. Removed back cover, belts, and motor.	____	____	____
3. Removed capacitor cover and wires.	____	____	____
4. Discharged capacitor.	____	____	____
5. Removed capacitor and installed replacement.	____	____	____
6. Reconnected wiring and replaced cover.	____	____	____
7. Replaced motor and drive belts.	____	____	____
8. Installed back cover.	____	____	____
9. Tested for proper operation.	____	____	____
10. Cleaned work area and stored equipment.	____	____	____

INSTRUCTOR'S GUIDE SHEET

REPLACE AN ELECTRIC DRYER BLOWER ASSEMBLY

OBJECTIVE

Given a clothes dryer with a defective blower assembly by the instructor, you will use the tools and service manual provided to remove and replace the blower assembly. You will be evaluated according to the instructor's final checklist.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

You will demonstrate your ability to replace an electric dryer blower assembly.

CONTENTS	LEARNING ACTIVITY #
Instruction Sheet I "Replace an Electric Dryer Blower Assembly"	3
Instructor's Final Checklist "Replace an Electric Dryer Blower Assembly"	4

CHECK-OUT ACTIVITY

Your instructor will provide an electric dryer and the necessary tools. You will replace the defective blower assembly to meet the manufacturer's specification.

REFERENCES

Whirlpool Corporation, Automatic Dryers, Whirlpool Corporation, Benton Harbor, MI.

INSTRUCTOR'S GUIDE SHEET

REPLACE AN ELECTRIC DRYER BLOWER ASSEMBLY

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have the student read about dryer blower assemblies.	Whirlpool Corporation Automatic Dryers, pp. 33-37.	
2.	Have the student observe a demonstration of replacing a dryer blower assembly.		
3.	Allow the student to practice replacing a dryer blower assembly.	Instruction Sheet I See tools and equipment list.	
4.	Allow the student to complete the check-out activity.	See tools and equipment list.	
	Evaluate the students performance.	Instructor's Final Checklist.	

TOOLS AND EQUIPMENT

Basic electrical repair tool kit, replacement blower assembly, service manual.

INSTRUCTOR'S FINAL CHECKLIST

REPLACE AN ELECTRIC DRYER BLOWER ASSEMBLY

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In replacing a dryer blower assembly, the student performed the following:

	FULLY AC	NOT AC	NOT AF
1. Disconnected dryer from power supply.			
2. Removed back panel.			
3. Removed blower assembly from dryer.			
4. Installed new blower assembly.			
5. Restored power and tested dryer operation.			
6. Cleaned work area and stored all equipment.			

INSTRUCTOR'S GUIDE SHEET

TROUBLESHOOT AN ELECTRIC DRYER

OBJECTIVE

Given various problems frequently found in automatic clothes dryers, you will diagnose the problem, expalin the tools and action needed to correct the problem. You will be evaluated according to the instructor's final checklist.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

You will demonstrate your knowledge of an electric dryer by troubleshooting problems assigned by your instructor.

CONTENTS	LEARNING ACTIVITY #
Instructor's Final Checklist "Troubleshoot an Electric Dryer"	4
Instruction Sheet I	4

CHECK-OUT ACTIVITY

Given a list of problems in an automatic clothes dryer, explain in writing the usual causes of the problems and the steps to correct the problems.

REFERENCES

Whirlpool Corporation, Automatic Dryers, Whirlpool Corporation, Benton Harbor, MI.

Trouble Diagnosis and Service Procedures, Whirlpool Corporation, Benton Harbor, MI.

INSTRUCTOR'S GUIDE SHEET

TROUBLESHOOT AN ELECTRIC DRYER

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have the student read about troubleshooting automatic clothes dryers.	Whirlpool Corporation, Automatic Dryers pp. 141-143, and Trouble Diagnosis and Service Procedures, pp. 32-34.	
2.	Have the student observe a demonstration on troubleshooting problems.		
3.	Allow the student to practice troubleshooting a clothes dryer.	See tools and equipment list.	
4.	Allow the student to complete the check-out activity.	Check-Out Activity	
	Evaluate the students performance using the instructor's final checklist.	Instructor's Final Checklist	

TOOLS AND EQUIPMENT

Basic electrical repair tool kit, VOM, replacement parts, service manual.

CHECK-OUT ACTIVITY

TROUBLESHOOTING AN ELECTRICAL DRYER

On a separate piece of paper explain the following. Identify the causes of the common problems listed below, explain the action to correct each problem, and the tools and materials needed for repair.

Problems:

1. Dryer doesn't start.
2. Motor hums, drum doesn't rotate.
3. Dryer will not shut off.
4. Dryer is noisy.
5. Clothes dry too slowly.

CHECK-OUT ACTIVITY
Answers

Problem	Possible Cause	Repair Procedure
1. Dryer will not run	No power to dryer (blown fuse or tripped breaker	Check Power Supply
	Terminal block inoperative	Check Terminal Block
	Centrifugal switch inoperative	Check Centrifugal Switch
	Motor winding burned out	Check Motor
	Open contact in timer	Check Timer
	Open contact in door switch	Check Door Switch
	Power cord defective	Check Power Cord
	Start switch inoperative	Check Start Switch
	Door is open	Check Door Alignment Check Door Latch
2. Dryer drum does not rotate, but motor runs	Belt off idler pulley	Check Belt
	Broken drive belt	Check Belt
	Defective idler puller	Check Idler
	Broken idler tension spring	Check Idler
	Drum binds	Check Drum Supports
3. Dryer will not turn off	Thermostat(s) inoperative	Check Thermostats - Electric Dryers
	Timer inoperative	Check Timer
	Resistor inoperative (electric dryers only)	Check Resistor
	Cold room	Room temperature must be 50°F or more
	Moisture sensor inoperative	Check Moisture Sensor

Tools and Materials Required:

1. Basic Electrical Repair Kit

    A. Standard screwdriver
    B. Phillips head screwdriver
    C. Socket wrench set 3/8" driver
    D. Nut driver set
    E. Pliers, 6" slipjoint, 6" needlenose
    F. Wire crimper/stripping tool
    G. Torx drivers
    H. Soldering iron and solder

2. Volt-ohmmeter/multimeter

3. Replacement parts

INSTRUCTOR'S FINAL CHECKLIST

TROUBLESHOOT AN ELECTRIC DRYER

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

	FULLY AC	NOT AC	NOT AP
In troubleshooting an automatic clothes dryer, the student performed the following:			
1. Read assigned materials.	____	____	____
2. Practiced troubleshooting dryers available in the shop.	____	____	____
3. Completed writing Student Self-Check I.	____	____	____

INSTRUCTOR'S GUIDE SHEET

INSTALL AN AUTOMATIC WASHER

OBJECTIVE

Given an automatic washer, service manual, and tools by the instructor, you will properly install an electric washing machine. The machine will operate within the manufacturer's specifications with no leaks. You will be rated according to the instructor's final checklist.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

You will demonstrate your ability to install an automatic washer.

CONTENTS	LEARNING ACTIVITY #
Instruction Sheet I "Installing an Automatic Washer"	4
Instructor's Final Checklist "Install An Automatic Washer"	5

CHECK-OUT ACTIVITY

You will install an automatic clothes washer. You will check for proper electrical supply, sufficient hot and cold water, and proper drain lines. The washer will operate within the manufacturer's specifications.

REFERENCES

Whirlpool Corporation, Understanding Automatic Washers, Whirlpool Corporation Benton Harbor, MI.

FILM "Delivery, Handling, and Installation of Whirlpool Laundry Products," Whirlpool Corporation, Benton Harbor, MI.

TASK ASSIGNMENT SHEET APR-044

INSTRUCTOR'S GUIDE SHEET

INSTALL AN AUTOMATIC WASHER

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have the student read about automatic washer installation.	Whirlpool Corporation, Understanding Automatic Washers, pp. 45-62.	
2.	Have the student view a film on washer installation.	Whirlpool Corporation, "Delivery, Handling, and Installation of Whirlpool Laundry Products.	
3.	Have the student answer the unit test questions.	Whirlpool Corporation, Understanding Automatic Washers, Test 4.	
4.	Allow the student to practice installing an electric washer.	Instruction Sheet I See tools and equipment list.	
5.	Allow the student to complete the check-out activity.	See tools and equipment list.	
	Evaluate the student according to the instructor's final checklist.	Instructor's Final Checklist.	

TOOLS AND EQUIPMENT

Basic appliance repair tool kit, manufacturer's installation instructions.

INSTRUCTOR'S FINAL CHECKLIST

INSTALL AN AUTOMATIC WASHER

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In installing an automatic clothes washer the student performed the following:

	FULLY AC	NOT AC	NOT AP
1. Checked proper space, plumbing, and electrical source.			
2. Leveled washer.			
3. Checked water supply and drainage.			
4. Checked water pressure.			
5. Explained operating procedures for washer.			
6. Cleaned work area and stored tools.			

INSTRUCTOR'S GUIDE SHEET

REPLACE AUTOMATIC WASHER DRIVE BELT

OBJECTIVE

The instructor will provide an automatic clothes washer, replacement belt, proper tools, and manufacturer's service manual. You will remove a worn/defective belt and install a replacement belt on automatic clothes washer. You will be evaluated according to instructor's final checklist.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

You will demonstrate your ability to install an automatic washer drive belt.

CONTENTS	LEARNING ACTIVITY #
Instruction Sheet I	3
Instructor's Final Checklist	4

CHECK-OUT ACTIVITY

Your instructor will provide an automatic clothes washer, a replacement belt, proper tools, and manufacturer's service manual. You will install the replacement belt so that the washer operates to the manufacturer's specification.

REFERENCE

Manufacturer's Service Manual.

INSTRUCTOR'S GUIDE SHEET

REPLACE AUTOMATIC WASHER DRIVE BELT

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have student read about automatic clothes washer belt.	Manufacturer's Service Manual.	
2.	Have student observe a presentation on belt replacement.		
3.	Have student practice replacing automatic clothes washer belt.	Manufacturer's Service Manual	
4.	Allow student to complete check-out listed on this task assignment.		
5.	Evaluate student performance.	Instructor's Final Checklist.	

TOOL AND EQUIPMENT

Basic appliance repair tool kit, replacement belt, and service manual.

INSTRUCTOR'S FINAL CHECKLIST

REPLACE AUTOMATIC WASHER DRIVE BELT

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In replacing the automatic washer belt, the student performed the following:

	FULLY AC	NOT AC	NOT AP
1. Disconnected power & water supply.	____	____	____
2. Inspected belt for wear/damage.	____	____	____
3. Removed old belt and installed new one.	____	____	____
4. Reconnected power and water supply.	____	____	____
5. Check washer operation.	____	____	____
6. Cleaned work area and stored tools and materials.	____	____	____

INSTRUCTOR'S GUIDE SHEET

REPLACE AUTOMATIC WASHER INJECTOR NOZZLE

OBJECTIVE

Given an automatic washer, test instruments, proper tools and a replacement water nozzle, you will replace the water injection nozzle. The washer must operate within the manufacturer's specifications with no leaks. You will be rated according to the instructor's final checklist.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

You will demonstrate your ability to install an automatic washer injector nozzle.

CONTENTS	LEARNING ACTIVITY #
Instruction Sheet I "Replace Automatic Washer Injector Nozzle"	5
Instructor's Final Checklist "Replace Automatic Washer Injector Nozzle"	6

CHECK-OUT ACTIVITY

You will replace a defective water injection nozzle on an automatic washer using tools and equipment, parts and a washer provided by the instructor. The washer will function to original specifications with no leaks.

REFERENCES

Whirlpool Corporation, Understanding Automatic Washers, Whirlpool Corporation, Benton Harbor, MI.

FILM "Servicing Mechanical and Water Systems Above the Baseplate, "Whirlpool Corporation, Benton Harbor, MI.

INSTRUCTOR'S GUIDE SHEET

REPLACE AUTOMATIC WASHER INJECTOR NOZZLE

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have the student read about automatic washer injector nozzles.	Whirlpool Corporation, Understanding Automatic Washers, pp. 87-100.	
2.	Have the student view a film on automatic washer service.	Whirlpool Corporation, "Servicing Mechanical and Water Systems Above the Baseplate."	
3.	Have the student observe a demonstration of replacing an injector nozzle.		
4.	Allow the student to complete the unit written test.	Whirlpool Corporation, Understanding Automatic Washers, p. 100	
5.	Allow the student to practice replacing an injector nozzle.	Instruction Sheet I See tools and equipment list.	
6.	Allow the student to complete the check-out activity.	See tools and equipment list.	
	Evaluate the student's performance according to the instructor's final checklist.	Instructor's Final Checklist.	

TOOLS AND EQUIPMENT

Basic appliance repair tool kit, water-proof cement, replacement injector nozzle.

INSTRUCTOR'S FINAL CHECKLIST

REPLACE AUTOMATIC WASHER INJECTOR NOZZLE

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In replacing a washer injector nozzle the student performed the following:	FULLY AC	NOT AC	NOT AP
1. Disconnected power supply.			
2. Removed panel for access to injector nozzle.			
3. Disconnected filler hose from nozzle.			
4. Installed replacement nozzle in same mounting position.			
5. Reconnected filler hose and aligned nozzle to prevent splashing.			
6. Replaced panel.			
7. Reconnected power supply.			
8. Tested washer for leaks.			
9. Cleaned work area and stored tools.			

INSTRUCTOR'S GUIDE SHEET

REPLACE AN AUTOMATIC WASHER TRANSMISSION

OBJECTIVE

Given an automatic washer, proper tools, a replacement transmission, and a service manual - you will remove a defective automatic washer transmission and install a replacement. You will be rated according to the instructor's final checklist.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

You will demonstrate your ability to replace an automatic washer transmission.

Instruction Sheet I "Replace an Automatic Washer Transmission"	5
Instructor's Final Checklist "Replace an Automatic Washer Transmission"	6

CHECK-OUT ACTIVITY

Your instructor will provide an automatic washer, proper tools, and a replacement transmission. You will install the replacement transmission so that the washer functions to original specifications.

REFERENCES

Whirlpool Corporation, Understanding Automatic Washers, Whirlpool Corporation, Benton Harbor, MI.

FILMSTRIP "Servicing Washer Mechanical and Water Systems Below the Baseplate," Whirlpool Corporation, Benton Harbor, MI.

INSTRUCTOR'S GUIDE SHEET

REPLACE AN AUTOMATIC WASHER TRANSMISSION

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have the student read about automatic washer transmissions.	Whirlpool Corporation Understanding Automatic Washers, Chapter 7.	
2.	Have the student view a filmstrip on washer transmissions.	Whirlpool Corporation, "Servicing Washer Mechanical and Water Systems Below the Baseplate."	
3.	Have the student observe a demonstration on replacing a washer transmission.		
4.	Have the student write the answers for the test in Chapter 7.	Whirlpool Corporation, Understanding Automatic Washer, Chapter 7.	
5.	Allow the student to practice replacing a washer transmission.	Instruction Sheet I See tools and equipment list.	
6.	Allow the student to complete the check-out activity.	See tools and equipment list.	
	Evaluate the student's performance using the instructor's final checklist.	Instructor's Final Checklist	

TOOLS AND EQUIPMENT

Basic appliance repair tool kit, replacement transmission, transmission oil, service manual.

INSTRUCTOR'S FINAL CHECKLIST

REPLACE AN AUTOMATIC WASHER TRANSMISSION

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In replacing an automatic washer transmission the student performed the following:

	FULLY AC	NOT AC	NOT AP
1. Disconnected power and water supplies.			
2. Removed washer parts to gain access to transmission.			
3. Removed defective transmission and installed replacement.			
4. Reassembled washer in correct sequence.			
5. Restored power and water connections and tested for proper operations.			
6. Cleaned work area and stored all materials.			

INSTRUCTOR'S GUIDE SHEET

REPLACE AUTOMATIC WASHER TEMPERATURE SWITCH

OBJECTIVE

Given an automatic washer, test instruments, proper tools, and a replacement water temperature switch by the instructor, you will replace a defective water temperature switch in an automatic washer. You will be rated according to the instructor's final checklist.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

You will demonstrate your ability to replace an automatic washer temperature switch.

CONTENTS	LEARNING ACTIVITY #
Instruction Sheet I "Replace Automatic Washer Temperature Switch"	4
Instructor's Final Checklist "Replace Automatic Washer Temperature Switch"	5

CHECK-OUT ACTIVITY

The instructor will provide an automatic washer hand tools, and a replacement water temperature switch. You will remove the defective water temperature switch and replace it with a new switch. The washer must operate within the manufacturer's specifications.

REFERENCES

Whirlpool Corporation, Understanding Automatic Washers, Whirlpool Corporation, Benton Harbor, MI.

FILMSTRIP "Reading and Understanding Wiring Diagrams for Washers", Whirlpool Corporation, Benton Harbor, MI.

INSTRUCTOR'S GUIDE SHEET

REPLACE AUTOMATIC WASHER TEMPERATURE SWITCH

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have the student read about washer water temperature switches.	Whirlpool Corporation Understand Automatic Washers, pp. 69-70.	
2.	Have the student view a filmstrip on temperature switch wiring.	Whirlpool Corporation, "Reading and Understanding Wiring Diagrams for Washers."	
3.	Have the student observe a demonstration on replacing a water temperature switch.		
4.	Allow the student to practice replacing water temperature switch.	Instruction Sheet I See tools and equipment list.	
5.	Allow the student to complete the check-out activity.	See tools and equipment list.	
	Evaluate the student's performance using the instructor's final checklist.	Instructor's Final Checklist.	

TOOLS AND EQUIPMENT

Basic appliance repair tool kit, VOM, soldering iron, resin core solder, replacement switch.

INSTRUCTOR'S FINAL CHECKLIST

REPLACE AUTOMATIC WASHER TEMPERATURE SWITCH

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In replacing an automatic washer temperature switch the student performed the following:

	FULLY AC	NOT AC	NOT AP
1. Accessed switch and diagramed wiring.			
2. Disconnected wiring from switch.			
3. Removed old switch and installed replacement.			
4. Connected washer to power supply and checked functioning of switch in all operating positions.			
5. Cleaned work area and stored all materials.			

INSTRUCTOR'S GUIDE SHEET

REPLACE AUTOMATIC WASHER TIMER

OBJECTIVE

Given an automatic washer, tools and a replacement timer by your instructor, you will remove and replace the timer. If the unit is a repairable timer, you will replace parts that are defective. You will be rated according to the instructor's final checklist.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

You will demonstrate your ability to replace an automatic washer timer.

CONTENTS	LEARNING ACTIVITY #
Instruction Sheet I "Student Self Check"	3
Instructor's Final Checklist "Replace Automatic Washer Timer"	5

CHECK-OUT ACTIVITY

Your instructor will provide an automatic washer, replacement timer and tools. You will remove and repair or replace the defective timer. The machine will function to the original specifications.

REFERENCES

Whirlpool Corporation, Understanding Automatic Washers, Whirlpool Corporation, Benton Harbor, MI.

FILMSTRIP "Understanding And Servicing Solid-State Electronic-Controlled Whirlpool Washers," Whirlpool Corporation, Benton Harbor, MI.

INSTRUCTOR'S GUIDE SHEET

REPLACE AUTOMATIC WASHER TIMER

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have the student read about automatic washer timers.	Whirlpool Corporation, Understanding Automatic Washers, pp. 63-69.	
2.	Have the student view a filmstrip presentation on washer timers.	Whirlpool Corporation, "Understanding and Servicing Solid-State Electronic-Controlled Whirlpool Washers.	
3.	Have the student answer the unit test questions on a separate sheet of paper.		
4.	Allow the student to complete the check-out activity.	See tools and equipment list.	
	Evaluate the student's performance according to the instructor's final checklist.	Instructor' Final Checklist	

TOOLS AND EQUIPMENT

Basic appliance repair tool kit, VOM, replacement timer, service manual.

STUDENT SELF-CHECK I

Answer Key

---

1. b
2. d
3. a
4. d
5. a
6. d
7. b
8. b
9. b
10. c

INSTRUCTOR'S FINAL CHECKLIST

REPLACE AUTOMATIC WASHER TIMER

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In replacing an automatic washer timer the student performed the following:

	FULLY AC	NOT AC	NOT AP
1. Tested washer functions.			
2. Disconnected power supply.			
3. Removed access panel.			
4. Diagramed electrical connections.			
5. Removed old timer.			
6. Installed replacement or repaired old timer.			
7. Reconnected power supply.			
8. Checked washer for proper operations.			
9. Cleaned work area and stored all materials.			

INSTRUCTOR'S GUIDE SHEET

REPLACE AUTOMATIC WASHER PRESSURE SWITCH

OBJECTIVE

Given an automatic washer, test instruments, tools, a replacement pressure switch, and a service manual by the instructor - you will remove a defective pressure switch and replace it with a new pressure switch . You will be rated according to the instructor's final checklist.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

You will demonstrate your ability to replace an automatic washer pressure switch.

CONTENTS	LEARNING ACTIVITY #
Instruction Sheet I "Replace Automatic Washer Pressure Switch"	4
Instructor's Final Checklist "Replace Automatic Washer Pressure Switch"	5

CHECK-OUT ACTIVITY

Your instructor will provide an automatic washer needing the pressure switch replaced, replacement parts, tools and materials. You will replace the pressure switch so that the washer operates within the manufacturer's specifications.

REFERENCES

Whirlpool Corporation, Understanding Automatic Washers, Whirlpool Corporation, Benton Harbor, MI.

FILMSTRIP "Servicing Washer Mechanical and Water Systems Above the Baseplate," Whirlpool Corporation, Benton Harbor, MI.

INSTRUCTOR'S GUIDE SHEET

REPLACE AUTOMATIC WASHER PRESSURE SWITCH

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have the student read about pressure switches.	Whirlpool Corporation, Understanding Automatic Washers, pp. 70-72.	
2.	Have the student view a filmstrip presentation	Whirlpool Corporation, "Servicing Washer Mechanical and Water Systems Above the Baseplate."	
3.	Have the student observe a demonstration of replacing a pressure switch.		
4.	Allow the student to practice replacing a pressure switch	Instruction Sheet I See tools and equipment list.	
5.	Allow the student to complete the check-out activity.	See tools and equipment list.	
	Evaluate the student's performance according to the instructor's final checklist.	Instructor's Final Checklist.	

TOOLS AND EQUIPMENT

Basic appliance repair tool kit, VOM, soldering iron, resin core solder, replacement pressure switch, service manual.

INSTRUCTOR'S FINAL CHECKLIST

REPLACE AUTOMATIC WASHER PRESSURE SWITCH

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In replacing an automatic washer pressure switch the student performed the following:

	FULLY AC	NOT AC	NOT AP
1. Disconnected power source.	____	____	____
2. Removed panels for access to pressure switch.	____	____	____
3. Removed wiring and pressure hose from switch.	____	____	____
4. Installed new switch.	____	____	____
5. Reconnected wiring and hose.	____	____	____
6. Replaced panels.	____	____	____
7. Checked switch for proper operation.	____	____	____
8. Cleaned work area and stored tools and materials.	____	____	____

INSTRUCTOR'S GUIDE SHEET

REPLACE AUTOMATIC WASHER DRAIN PUMP

OBJECTIVE

The instructor will provide an automatic washer, proper tools, a replacement drain pump, and a service manual. You will remove a defective drain pump and install a replacement on the automatic washer. You will be evaluated according to the instructor's final checklist.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

You will demonstrate your ability to replace an automatic washer drain pump.

CONTENTS	LEARNING ACTIVITY #
Instruction Sheet I "Replace Automatic Washer Drain Pump"	4
Instructor's Final Checklist "Replace Automatic Washer Drain Pump"	5

CHECK-OUT ACTIVITY

Your instructor will provide an automatic washer, tools, service manual, and a replacement drain pump. You will install the replacement drain pump so that the washer operates to the manufacturer's specifications.

REFERENCES

Whirlpool Corporation, Understanding Automatic Washers, Whirlpool Corporation, Benton Harbor, MI.

____________, filmstrip, "Servicing Washer Mechanical and Water Systems Below the Baseplate," Whirlpool Corporation, Benton Harbor, MI

INSTRUCTOR'S GUIDE SHEET

REPLACE AUTOMATIC WASHER DRAIN PUMP

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have the student read about washer pumps.	Whirlpool Corporation, Understanding Automatic Washers, pp. 87-91.	
2.	Have the student view a presentation on automatic washer pumps.	Whirlpool Corporation, "Servicing Washer Mechanical and Water Systems Below the Baseplate."	
3.	Have the student answer questions on washer pumps.	Whirlpool Corporation, Understanding Automatic Washers, p. 91.	
4.	Allow the student to practice replacing and repairing a washer drain pump.	Instruction Sheet I See tools and equipment list.	
5.	Allow the student to complete the check-out activity.	See tools and equipment list.	
	Evaluate the student's performance according to the instructor's final checklist.	Instructor's Final Checklist.	

TOOLS AND EQUIPMENT

Basic appliance repair tool kit, replacement drain pump or repair kit, service manual.

INSTRUCTOR'S FINAL CHECKLIST

REPLACE AUTOMATIC WASHER DRAIN PUMP

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In replacing a washer drain pump the student performed the following:	FULLY AC	NOT AC	NOT AP
1. Tested appliance to determine problem.	____	____	____
2. Removed drain pump.	____	____	____
3. Disassembled and inspected drain pump.	____	____	____
4. Repaired damaged pump if possible.	____	____	____
5. Reinstalled pump in washer.	____	____	____
6. Cleaned work area and stored tools.	____	____	____

INSTRUCTOR'S GUIDE SHEET

REPLACE AN AUTOMATIC WASHER ELECTRIC MOTOR

OBJECTIVE

Given an automatic washer, hand tools, a replacement electric motor, and a service manual by the instructor, you will replace a defective electric motor. You will be evaluated according to the instructor's final checklist.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

You will demonstrate your ability to replace an automatic washer electric motor.

CONTENTS	LEARNING ACTIVITY #
Instruction Sheet I "Replace an Automatic Washer Electric Motor"	4
Instructor's Final Checklist "Replace an Automatic Washer Electric Motor"	5

CHECK-OUT ACTIVITY

Your instructor will provide you with an automatic washer, replacement electric motor, tools and supplies. You will replace the washer motor. On completion the washer will operate within manufacturer's specifications with no leaks.

REFERENCES

Whirlpool Corporation, Understanding Automatic Washers, Whirlpool Corporation, Benton Harbor, MI.

INSTRUCTOR'S GUIDE SHEET

REPLACE AN AUTOMATIC WASHER ELECTRIC MOTOR

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have the student read about washer drive motors.	Whirlpool Corporation, Understanding Automatic, Washers, Chapter 5.	
2.	Have the student observe a demonstration on replacing a washer motor.		
3.	Have the student write the answers for questions in Chapter 5.	Whirlpool Corporation, Understanding Automatic Washers, Chapter 5.	
4.	Allow the student to practice replacing a washer motor.	Instruction Sheet I See tools and equipment list.	
5.	Allow the student to complete the check-out activity.	See tools and equipment list.	
	Evaluate the student's performance according to the instructor's final checklist.	Instructor's Final Checklist.	

TOOLS AND EQUIPMENT

Basic appliance repair tool kit, VOM, replacement electric motor, appropriate service manual.

INSTRUCTOR'S FINAL CHECKLIST

REPLACE AN AUTOMATIC WASHER ELECTRIC MOTOR

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In replacing an automatic washer electric motor the student performed the following:

	FULLY AC	NOT AC	NOT AP
1. Disconnect power supply.			
2. Loosened motor mounting.			
3. Removed drive belt and electrical connections from motor.			
4. Removed old motor and installed replacement.			
5. Reinstalled belt and electrical connections.			
6. Connected power supply and checked washer operation.			

INSTRUCTOR'S GUIDE SHEET

INSTALL AN ELECTRIC WATER HEATER

OBJECTIVE

Given an electric water heater and tools by the instructor, you will install an electric water heater. The system must operate to manufacturer's specifications with no leaks. You will be evaluated according to the instructor's final checklist.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

You will demonstrate your ability to install an electric water heater.

CONTENTS	LEARNING ACTIVITY #
Instruction Sheet I "Install An Electric Water Heater"	3
Instructor's Final Checklist	4

CHECK-OUT ACTIVITY

Your instructor will provide an electric water heater and tools. You will install the water heater with no leaks and test the water heater for proper operation.

REFERENCES

Meyerink, G. (1973), Appliance Service Handbook, Prentice-Hall, Inc. Englewood Cliffs, NJ.

INSTRUCTOR'S GUIDE SHEET

INSTALL AN ELECTRIC WATER HEATER

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have the student read about water heater installation.	Meyerink, Appliance Service Handbook, pp. 404-411.	
2.	Have the student observe the installation of an electric water heater.		
3.	Allow the student to practice installing a water heater.	See tools and equipment list.	
4.	Allow the student to complete the check-out activity.	See tools and equipment list.	
	Evaluate the student's performance.	Instructor's Final Checklist.	

TOOLS AND EQUIPMENT

Basic appliance repair tool kit.

INSTRUCTOR'S FINAL CHECKLIST

INSTALL AN ELECTRIC WATER HEATER

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In installing an electric water heater the student performed the following:

	FULLY AC	NOT AC	NOT AF
1. Selected the proper location for hot water heater.			
2. Gathered necessary tools.			
3. Unpacked the hot water heater.			
4. Installed the hot water heater.			
5. Checked for proper operation.			
6. Cleaned and stored all materials.			

INSTRUCTOR'S GUIDE SHEET

REPLACE ELECTRIC WATER HEATER HEATING ELEMENT

OBJECTIVE

The instructor will furnish an electric water heater, test instruments, tools, and a replacement heating element. You will remove and install a heating element in the water heater. You will be rated according to the instructor's final checklist.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

You will demonstrate your ability to replace an electric water heater heating element.

CONTENTS	LEARNING ACTIVITY
Instruction Sheet I "Replace Electric Water Heater Heating Element"	3
Student Self Check I	4
Instructor's Final Checklist "Replace Electric Water Heater Heating Element"	5

CHECK-OUT ACTIVITY

Your instructor will provide an electric water heater, tools and equipment and a replacement heating element. Install the replacement heating element in the water heater so that is operates to proper specifications.

REFERENECES

Meyerink, G., (1973), Appliance Service Handbook, Prentice-Hall, Inc., Englewood Cliffs, NJ.

INSTRUCTOR'S GUIDE SHEET

REPLACE ELECTRIC WATER HEATER HEATING ELEMENT

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have the student read about water heaters.	Meyerink, Appliance Service Handbook, pp. 405-411.	
2.	Have the student observe a demonstration on replacing a heating element.		
3.	Allow the student to practice replacing a heating element in a water heater.	Instruction Sheet I See tools and equipment list.	
4.	Have the student answer the unit test questions.	Instruction Sheet II	
5.	Allow the student to complete the check-out activity.	See tools and equipment list.	
	Evaluate the student's performance.	Instructor's Final Checklist.	

TOOLS AND EQUIPMENT

Basic appliance repair tool kit, VOM, replacement heating element.

INSTRUCTOR'S FINAL CHECKLIST

REPLACE ELECTRIC WATER HEATER HEATING ELEMENT

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In replacing a defective heating element in an electric water heater the student performed the following:

	FULLY AC	NOT AC	NOT AP
1. Disconnected the power supply before servicing the unit.			
2. Gathered the necessary tools and materials.			
3. Removed the defective element.			
4. Installed a new element to proper specifications.			
5. Checked water heater for proper operation.			
6. Cleaned and stored all materials in proper place.			
7. Performed all activities in a safe manner.			

INSTRUCTOR'S GUIDE SHEET

REPLACE DEFECTIVE WIRING ON A WATER HEATER

OBJECTIVE

The instructor will provide a water heater, VOM, tools, and new wiring. You will remove defective wiring and install new wiring in the water heater circuits. You will be rated according to the instructor's final checklist.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

You will demonstrate your knowledge of water heater wiring circuits by replacing the wiring on an electric water heater.

CONTENTS	LEARNING ACTIVITY #
Instruction Sheet I "Replace Defective Wiring On a Water Heater"	3
Instruction Sheet II "Student Self Check"	4
Instructor's Final Checklist	5

CHECK-OUT ACTIVITY

Your instructor will provide an electric water heater, new wiring, and the necessary tools. You will correctly rewire the electric water heater wiring circuits to the manufacturer's specifications.

REFERENCES

Meyerink, G., (1973), Appliance Service Handbook, Prentice-Hall, Inc., Englewood Cliffs, NJ.

INSTRUCTOR'S GUIDE SHEET

REPLACE DEFECTIVE WIRING ON A WATER HEATER

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have the student read about water heater electrical circuits.	Meyerink, Appliance Service Handbook pp. 405-411.	
2.	Have the student observe a demonstration on testing and replacing wiring.		
3.	Allow the student to practice testing and replacing wiring.	Instruction Sheet I See tools and equipment list.	
4.	Have the student answer the questions in the Student Self-Check.		
5.	Allow the student to complete the check-out activity.	See tools and equipment list.	
	Evaluate the student's performance.	Instructor's Final Checklist.	

TOOLS AND EQUIPMENT

Basic appliance repair tool kit, new wiring, VOM.

INSTRUCTOR'S FINAL CHECKLIST

REPLACE DEFECTIVE WIRING ON A WATER HEATER

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In replacing wiring in a electric water heater the student performed the following:

	FULLY AC	NOT AC	NOT AP
1. Disconnected the power before servicing the unit.			
2. Gathered the necessary tools and materials.			
3. Removed defective wiring on water heater.			
4. Replaced new wiring on water heater.			
5. Checked the water heater for proper operation.			
6. Cleaned and stored all materials in proper place.			

INSTRUCTOR'S GUIDE SHEET

REPLACE ELECTRIC WATER HEATER THERMOSTAT

OBJECTIVE

Given a water heater with a defective thermostat, tools, and equipment by the instructor, you will remove and replace a thermostat in an electric water heater. You will be rated according to the instructor's final checklist.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

You will demonstrate your ability to replace the thermostat on an electric water

CONTENTS	LEARNING ACTIVITY #
Instruction Sheet I "Replace Electric Water Heater Thermostat"	3
Student Self-Check I	4

CHECK-OUT ACTIVITY

The instructor will provide an electric water heater, a replacement thermostat, proper equipment and tools. Install the replacement thermostat so that the heater operates within the manufacturer's specifications.

REFERENCES

Meyerink, G., (1973), Appliance Service Handbook, Prentice-Hall, Inc., Englewood Cliffs, NJ.

INSTRUCTOR'S GUIDE SHEET

REPLACE ELECTRIC WATER HEATER THERMOSTAT

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have the student read in a text about thermostats.	Meyerink, Appliance Service Handbook, pp. 405-411.	
2.	Have the student observe a demonstration of replacing a water heater thermostat.		
3.	Allow the student to practice replacing a water heater thermostat.	Instruction Sheet I See tools and equipment list.	
4.	Have the student answer in writing the questions on thermostats.	See tools and equipment list.	
5.	Allow the student to complete the check-out activity.	See tools and equipment list.	
	Evaluate the student's performance.	Instructor's Final Checklist.	

TOOLS AND EQUIPMENT

Basic appliance repair tool kit, VOM, replacement thermostat.

INSTRUCTOR'S FINAL CHECKLIST

REPLACE ELECTRIC WATER HEATER THERMOSTAT

Performance Levels: All items must receive a **rating of ACCOMPLISHED.** If any items are rated NOT ACCOMPLISHED, the student and **the instructor will decide** if any Learning Activities must be repeated.

In replacing an electric water heater thermostat the student performed the following:

	FULLY AC	NOT AC	NOT AP
1. Disconnected the power supply.			
2. Removed the control panel.			
3. Removed the defective thermostat.			
4. Installed a new thermostat.			
5. Replaced the cover.			
6. Checked the water heater for proper operation.			
7. Cleaned and stored all material in proper place.			

TASK ASSIGNMENT SHEET APR-057

INSTRUCTOR'S GUIDE SHEET

INSTALL AN AUTOMATIC DISHWASHER

OBJECTIVE

Given an automatic dishwasher and the necessary tools by the instructor, you will install the dishwasher so that it operates within the manufacturer's specifications. You will be rated according to the instructor's final checklist.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

You will demonstrate your ability to install an automatic dishwasher.

CONTENTS	LEARNING ACTIVITY #
Instruction Sheet I "Install an Automatic Dishwasher"	3
Instructor's Final Checklist	4

CHECK-OUT ACTIVITY

Your instructor will provide an automatic dishwasher and tools. You will install the dishwasher to the manufacturer's specifications.

REFERENCES

Meyerink, G., (1973), Appliance Service Handbook, Prentice-Hall, Inc., Englewood Cliffs, NJ.

INSTRUCTOR'S GUIDE SHEET

INSTALL AN AUTOMATIC DISHWASHER

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have the student read about appliance installation.	Meyerink, Appliance Service Handbook, pp. 42-44.	
2.	Have the student observe a demonstration of installing a dishwasher.		
3.	Allow the student to practice installing an automatic dishwasher.	Instruction Sheet I See tools and equipment list.	
4.	Allow the student to complete the check-out activity.	See tools and equipment list.	
	Evaluate the student's performance.	Instructor's Final Checklist.	

TOOLS AND EQUIPMENT

Basic appliance repair tool kit, level, washer installation kit.

INSTRUCTOR'S FINAL CHECKLIST

INSTALL AN AUTOMATIC DISHWASHER

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In installing an automatic dishwasher the student performed the following:	FULLY AC	NOT AC	NOT AF
1. Installed the drain line properly.	____	____	____
2. Installed the inlet pipe from hot water supply.	____	____	____
3. Installed the lead-in wire from the fuse panel.	____	____	____
4. Checked hot water and pressure.	____	____	____
5. Leveled machine, installed fuses.	____	____	____
6. Checked for proper grounding.	____	____	____
7. Tested for proper operation.	____	____	____
8. Cleaned and stored all materials.	____	____	____

INSTRUCTOR'S GUIDE SHEET

REPLACE SWITCHES ON AN AUTOMATIC DISHWASHER

OBJECTIVE

Given an automatic dishwasher, replacement switches, tools, and a service manual, you will replace defective switches as necessary to restore the dishwasher to proper operation. You will be rated according to the instructor's final checklist.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

You will demonstrate your knowledge of the function of the electrical switches on a automatic dishwasher by replacing those indicated by your instructor.

CONTENTS	LEARNING ACTIVITY #
Instructor's Final Checklist	4

CHECK-OUT ACTIVITY

Your instructor will provide an automatic dishwasher, replacement switches, tools, and a service manual. You will replace switches to restore dishwasher operation.

REFERENCE

Meyerink, G., (1973), Appliance Service Handbook, Prentice-Hall, Inc., Englewood Cliffs, NJ.

Whirlpool Corporation, Automatic Dishwasher, Whirlpool Corporation, Benton Harbor, MI.

INSTRUCTOR'S GUIDE SHEET

REPLACE SWTICHES ON AN AUTOMATIC DISHWASHER

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have the student read about switches for an automatic dishwasher.	Whirlpool Corporation, Automatic Dishwasher, pp. 40-43, Meyerink, G., Appliance Service Handbook, pp. 247-255.	
2.	Have the student observe a demonstration of switch replacement.		
3.	Allow the student to practice replacing switches on an automatic dishwasher.	See tools and equipment list.	
4.	Allow the student to complete the check-out activity.	See tools and equipment list.	
	Evaluate the student's performance.	Instructor's Final Checklist.	

TOOLS AND EQUIPMENT

Basic appliance repair tool kit, VOM, soldering iron and solder, replacement switches, service manual.

INSTRUCTOR'S FINAL CHECKLIST

REPLACE SWITCHES ON AN AUTOMATIC DISHWASHER

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In replacing defective switches on an automatic dishwasher, the student performed the following:

	FULLY AC	NOT AC	NOT AP
1. Removed panels for access to switches.	____	____	____
2. Diagnosed defective switch.	____	____	____
3. Secured correct replacement switch.	____	____	____
4. Disconnected wiring and removed old switch.	____	____	____
5. Installed replacement and connected wiring.	____	____	____
6. Checked switch for correct operation.	____	____	____
7. Installed panels.	____	____	____
8. Cleaned work area and stored tools.	____	____	____

INSTRUCTOR'S GUIDE SHEET

REPLACE A DISHWASHER MOTOR AND PUMP ASSEMBLY

OBJECTIVE

Given an automatic dishwasher, replacement motor and pump assembly, tools, and test instruments you will remove a defective motor and pump assembly and install a replacement. You will be rated according to the instructor's final checklist.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

Your will demonstrate your ability to replace a dishwasher motor and pump assembly.

CONTENTS	LEARNING ACTIVITY #
Instruction Sheet I "Replace a Dishwasher Motor and Pump Assembly"	3
Instructor's Final Checklist	4

CHECK-OUT ACTIVITY

Your instructor will provide an automatic dishwasher replacement motor and pump assembly, tools, and test instruments. You will remove the defective motor and pump assembly and install a replacement.

REFERENCE

Whirlpool Corporation, "The Mechanics of Whirlpool Dishwashers," Whirlpool Corporation, Benton Harbor, MI.
_______, Whirlpool Dishwashers, Benton Harbor, MI.

INSTRUCTOR'S GUIDE SHEET

REPLACE A DISHWASHER MOTOR AND PUMP ASSEMBLY

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have the student read about automatic dishwashers.	Whirlpool Corporation, "The Mechanics of Whirlpool Dishwashers", KD-1 Whirlpool Dishwasher, pp. 18-25 and p. 46	
2.	Have the student observe a demonstration of replacing a dishwasher motor and pump.		
3.	Allow the student to practice replacing a motor and pump assembly.	Instruction Sheet I See tools and equipment list.	
4.	Allow the student to complete the check-out activity.	See tools and equipment list.	
	Evaluate the student's performance.	Instructor's Final Checklist.	

INSTRUCTOR'S FINAL CHECKLIST

REPLACE A DISHWASHER MOTOR AND PUMP ASSEMBLY

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In replacing an automatic dishwasher motor and pump assembly the student performed the following:	FULLY AC	NOT AC	NOT AP
1. Disconnected power supply.			
2. Removed the panel and tilted the washer.			
3. Removed the fan blade.			
4. Disconnected the drain hose from the pump.			
5. Removed screws holding the motor-pump.			
6. Removed the impeller, pump housing and wiring.			
7. Installed the new motor and drain pump assembly.			
8. Reconnect power supply.			
9. Checked for proper operation.			

INSTRUCTOR'S GUIDE SHEET

REPLACE AUTOMATIC DISHWASHER TIMER

OBJECTIVE

Given an electric dishwasher, a replacement timer, proper tools, and a service manual from the instructor, you will install the timer to the manufacturer's specification. You will be evaluated according to the instructor's final checklist.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

You will demonstrate your ability to replace an automatic dishwasher timer.

CONTENTS	LEARNING ACTIVITY #
Instructor's Final Checklist	4

CHECK-OUT ACTIVITY

Your instructor will provide an electric dishwasher, a replacement timer, and proper tools. You will remove and replace a defective timer so that the dishwasher operates to the manufacturer's specifications.

REFERENCES

Whirlpool Corporation, Automatic Dishwashers, Whirlpool Corporation, Benton Harbor, MI.

INSTRUCTOR'S GUIDE SHEET

REPLACE AUTOMATIC DISHWASHER TIMER

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have the student read about timer operation.	Whirlpool Corporation, Automatic Dishwasher, pp. 35-38.	
2.	Have the student observe a demonstration of replacing a dishwasher timer.		
3.	Allow the student to practice replacing a dishwasher timer.	See tools and equipment list.	
4.	Allow the student to complete the check-out activity listed for this task assignment.	See tools and equipment list.	
	Evaluate the student's performance.	Instructor's Final Checklist.	

TOOLS AND EQUIPMENT

Basic appliance repair tool kit, service manual, VOM.

INSTRUCTOR'S FINAL CHECKLIST

REPLACE AUTOMATIC DISHWASHER TIMER

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In replacing a timer on an automatic dishwasher, the student performed the following:

	FULLY AC	NOT AC	NOT AP
1. Gathered necessary tools and materials.	____	____	____
2. Removed defective timer from dishwasher.	____	____	____
3. Installed correct replacement timer.	____	____	____
4. Tested timer for proper operation.	____	____	____
5. Cleaned work area and stored all materials.	____	____	____

INSTRUCTOR'S GUIDE SHEET

REPLACE AUTOMATIC DISHWASHER HEATING ELEMENT

OBJECTIVE

Given an automatic dishwasher, test instruments, hand tools, a replacement heating element, and a service manual, you will replace a defective heating element. You will be rated according to the instructor's final checklist.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

You will demonstrate your ability to replace an automatic dishwasher heating element.

CONTENTS	LEARNING ACTIVITY #
Instruction Sheet "Replace Automatic Dishwasher Heating Element"	3
Instructor's Final Checklist	4

CHECK-OUT ACTIVITY

The instructor will provide an automatic dishwasher, a replacement heating element, tools and equipment. You will remove a defective heating element and replace it with a new heating element to the manufacturer's specification.

REFERENCES

Whirlpool Corporation, Automatic Dishwasher, Whirlpool Corporation, Benton Harbor, MI.

Meyerink, G., (1973), Appliance Service Handbook, Prentice-Hall, Inc, Englewood Cliffs, NJ.

INSTRUCTOR'S GUIDE SHEET

REPLACE AUTOMATIC DISHWASHER HEATING ELEMENT

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have the student read about heating elements.	Whirlpool Corporation, Automatic Dishwashers, page 34. Meyerink, Appliance Service Handbook pages 93-95.	
2.	Have the student observe a demonstration of replacing a heating element.		
3.	Allow the student to practice replacing a heating element.	Instruction Sheet I See tools and equipment list.	
4.	Allow the student to complete the check-out activity listed for this task assignment.	See tools and equipment list.	
	Evaluate the student's performance.	Instructor's Final Checklist.	

INSTRUCTOR'S FINAL CHECKLIST

REPLACE AUTOMATIC DISHWASHER HEATING ELEMENT

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In replacing an automatic dishwasher heating element the student performed the following:

	FULLY AC	NOT AC	NOT AP
1. Disconnected power supply.			
2. Removed the loading door and racks.			
3. Removed panel and disconnected wires to heater element.			
4. Removed heater from mounting.			
5. Installed replacement heater.			
6. Reassembled dishwasher.			
7. Tested dishwasher for proper operation.			
8. Cleaned work area and stored all equipment.			

INSTRUCTOR'S GUIDE SHEET

CHECK DISHWASHER FOR PROPER OPERATION

OBJECTIVE

Given an automatic dishwasher by the instructor, you will distinguish the different cycles of the dishwasher, test the washer for proper operation by running the machine through its cycles. You will be rated according to the instructor's final checklist.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

You will demonstrate your understanding of the proper operating of a dishwashe by testing the various cycles.

CONTENTS	LEARNING ACTIVITY #
Instructor's Final Checklist	5

CHECK-OUT ACTIVITY

Your instructor will provide an automatic dishwasher and test equipment if needed. You will test each cycle of the dishwasher for proper operation, water temperature, and select proper detergent.

REFERENCES

Whirlpool Corporation, Automatic Dishwasher, Whirlpool Corporation, Benton Harbor, MI.
____________, Film "Automatic Dishwashers," Whirlpool Corporation, Benton Harbor, MI.

INSTRUCTOR'S GUIDE SHEET

CHECK DISHWASHER FOR PROPER OPERATION

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have the student read about the cycles of dishwasher operation.	Whirlpool Corporation Automatic Dishwashers, pages 15-17.	
2.	Have the student observe a demonstration on checking dishwasher cycles.		
3.	Have the student view a film on dishwashers.	"Automatic Dishwashers," Whirlpool Corporation.	
4.	Allow the student to practice checking dishwasher cycles.	See tools and equipment list.	
5.	Allow the student to complete the check-out activity listed for this task assignment.	See tools and equipment list.	
	Evaluate the student's performance.	Instructor's Final Checklist.	

TOOLS AND EQUIPMENT

Manufacturer's operating instructions, basic appliance repair tool kit.

INSTRUCTOR'S FINAL CHECKLIST

CHECK DISHWASHER FOR PROPER OPERATION

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In checking the operating cycles of a automatic dishwasher the student performed the following:

	FULLY AC	NOT AC	NOT AP
1. Checked all cycles for proper operation.	____	____	____
2. Checked water for proper operating temperature.	____	____	____
3. Selected proper detergent for use.	____	____	____

INSTRUCTOR'S GUIDE SHEET

UNDERSTAND AUTOMATIC WASHER WIRING DIAGRAMS

OBJECTIVE

Using material provide by the instructor, you will study the wiring diagrams of an automatic clothes washer and diagnose problems in the electrical circuits. You will recognize symbols used in electrical diagrams quickly and accurately. Troubleshooting diagnosis should begin by visually inspecting and listening to machine operation.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

You will demonstrate your understanding of the wiring diagrams for automatic washers by diagnosing problems in the electrical circuits.

CONTENTS	LEARNING ACTIVITY #
Instruction Sheet I "Understand Automatic Washer Wiring Diagrams"	3

CHECK-OUT ACTIVITY

You instructor will provide an automatic clothes washer and wiring diagram. You will interpret the wiring diagram and compare the wiring diagram with the washer circuits. You will complete the unit test on wiring diagrams with a score of 85% or higher.

REFERENCES

Whirlpool Corporation, Understanding Automatic Washers, Whirlpool Corporation, Benton Harbor, MI.

INSTRUCTOR'S GUIDE SHEET

UNDERSTAND AUTOMATIC WASHER WIRING DIAGRAMS

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have the student read about clothes washer wiring diagrams.	Whirlpool Corporation, *Understanding Automatic Washers*, pages 125-135.	
2.	Have the student observe a presentation on wiring diagram symbols.	Instruction Sheet I.	
3.	Have the student practice identifying wiring diagrams symbols.	Instruction Sheet I	
4.	Have the student compare the wiring with the clothes washer's electrical circuits.	Manufacturer's wiring diagrams.	
5.	Allow the student to complete the check-out activity listed for this task assignment.	Manufacturer's wiring diagram.	
	Evaluate the student's performance.	Instructor's Final Checklist.	

TOOLS AND EQUIPMENT

Manufacturer's wiring diagrams and service manual.

INSTRUCTOR'S FINAL CHECKLIST

UNDERSTAND AUTOMATIC WASHER WIRING DIAGRAMS

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In learning automatic washer wiring diagrams and electric circuits the student performed the following:

	FULLY AC	NOT AC	NOT AP
1. Read the material on wiring diagrams.			
2. Identified wiring diagrams symbols correctly.			
3. Checked wiring diagrams against electrical circuits.			
4. Completed unit test with a score of 85% or higher.			

INSTRUCTOR'S GUIDE SHEET

UNDERSTAND FUNDAMENTALS OF MICROWAVE OVENS

OBJECTIVE

Given a microwave oven and the necessary tools and equipment by the instrucor, **you will expose the components of the unit and identify the parts by name and** function. You will identify and give the purpose of the safety features in **the unit.**

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

You will demonstrate your understanding of the fundamentals of microwave ovens by identifying the safety features and the purposes for having them.

CONTENTS	LEARNING ACTIVITY #
Instructor's Final Checklist	5

CHECK-OUT ACTIVITY

Given an exploded view of a microwave oven, you will identify in writing the the component parts of the unit. You will identify and describe the safety features of the microwave. A score of 85% or higher is required to complete this check-out activity.

REFERENCES

Meyerink, G., (1973), Appliance Service Handbook, Prentice-Hall, Inc., Englewood Cliffs, NJ.

Whirlpool Corporation, "The Fundamentals of Whirlpool Microwave Ovens," Whirlpool Corporation, Benton Harbor, MI.

INSTRUCTOR'S GUIDE SHEET

UNDERSTAND FUNDAMENTALS OF MICROWAVE OVENS

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have the student read about microwave oven operation.	Meyerink, Appliance Service Handbook page 342-351.	
2.	Have the student view a slide presentation on fundamentals of microwave ovens.	Whirlpool Corporation, "The Fundamentals of Whirlpool Microwave Ovens."	
3.	Allow the student to practice identifying the components of a microwave oven.	See tools and equipment list.	
4.	Have the student check his knowledge of the fundamentals of microwave ovens.	Whirlpool Cooperation, recall booklet, "The Fundamentals of Microwave Oven."	
5.	Allow the student to complete the check-out activity for this task assignment.	See tools and equipment list.	
	Evaluate the student's performance.	Instructor's Final Checklist.	

INSTRUCTOR'S FINAL CHECKLIST

UNDERSTAND FUNDAMENTALS OF MICROWAVE OVENS

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In learning about the fundamental of microwave ovens, the student completed the following:

	FULLY AC	NOT AC	NOT AP
1. Read assigned material on microwave ovens.	____	____	____
2. Observed the slide presentation on microwave ovens.	____	____	____
3. Identified component parts and safety features from an exploded view of a microwave oven.	____	____	____
4. Answered the questions in the recall booklet with a score of 85% or higher.	____	____	____

INSTRUCTOR'S GUIDE SHEET

INSTALL A MICROWAVE OVEN

OBJECTIVE

Given a microwave oven by the instructor, you will demonstrate your knowledge of the correct installation procedure. You will be rated according to the instructor's final checklist.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSGINMENT SHEET

You will demonstrate your ability to install a microwave oven.

CONTENTS	LEARNING ACTIVITY #
Instruction Sheet I	3 & 4
Instructor's Final Checklist	4

CHECK-OUT ACTIVITY

You will install a micrcowave oven. Check the operation of the oven after installation and explain the various functions of the oven.

REFERENCES

Microwave oven manufacturer's installation instructions.

INSTRUCTOR'S GUIDE SHEET

INSTALL A MICROWAVE OVEN

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have the student read about microwave oven installation.	Instruction Sheet I	
2.	Have the student observe a demonstration on the installation of microwave ovens.		
3.	Allow the student to practice installing a microwave oven.	Instruction Sheet I	
4.	Have the student complete the check-out activity listed for this task assignment. Evaluate the student's performance.	Instructor's Final Checklist.	

INSTRUCTOR'S FINAL CHECKLIST

INSTALL A MICROWAVE OVEN

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In installing a microwave oven the student performed the following:

	FULLY AC	NOT AC	NOT AP
1. Removed all materials from inside the oven.	____	____	____
2. Placed the oven with proper ventilation space.	____	____	____
3. Connected appliance to 120 volt, 60 Hz, A.C. power supply with a grounded 3-prong receptacle.	____	____	____
4. Did not use an extension cord.	____	____	____
5. Cleaned work area and stored equipment.	____	____	____

INSTUCTOR'S GUIDE SHEET

DIAGNOSE AND REPAIR MICROWAVE OVENS

OBJECTIVE

Given a microwave oven and the proper tools by your instructor, you will check the operation of a microwave oven and diagnose any malfunction. The repaired unit will function to the manufacturer's specification. You will be rated according to the instructor's final checklist.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

You will demonstrate your ability to diagnose and correct (repair or replace) any common problems with this appliance.

CONTENTS	LEARNING ACTIVITY #
Instructor's Final Checklist	5

CHECK-OUT ACTIVITY

Given a microwave oven and the proper tools and equipment, you will check the unit and determine if all functions are operating properly. When malfunctions are found, you are to repair them.

REFERENCES

Myerink, Appliance Service Handbook, Prentice-Hall, Inc., Englewood Cliffs, NJ.

Manufacturers Service Manual.

INSTRUCTOR'S GUIDE SHEET

DIAGNOSE AND REPAIR MICROWAVE OVEN

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have the student read about microwave ovens.	Myerink, Appliance Service Handbook, pp. 342-351.	
2.	Have the student observe a presentation on troubleshooting procedures for microwave ovens		
3.	Allow the student to practice diagnosing and repairing a microwave oven.	See tools and equipment list.	
4.	Allow the student to complete the check-out activity for this task assignment.	See tools and equipment list.	
5.	Evaluate student performance.	Instructor's Final Checklist.	

TOOLS AND EQUIPMENT

Basic appliance repair tool kit, VOM, and replacement parts.

INSTRUCTOR'S FINAL CHECKLIST

DIAGNOSE AND REPAIR MICROWAVE OVEN

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In diagnosing and repairing a microwave oven, the student performed the following:	FULLY AC	NOT AC	NOT AP
1. Programmed and operated the oven through all operating functions.	____	____	____
2. Followed safety procedures in accessing components of the oven.	____	____	____
3. Identified reasons for malfunction.	____	____	____
4. Removed and replaced defective component.	____	____	____
5. Tested oven operation.	____	____	____
6. Cleaned work area and stored tools.	____	____	____

INSTRUCTOR'S GUIDE SHEET

DIAGNOSE AND REPAIR MARK SERIES MICROWAVE OVENS

OBJECTIVE

Given a microwave oven and the necessary tools by your instructor, you will check the operation of the oven and diagnose any malfunctions. The repaired unit will function to the manufacturer's specifications. You will be rated according to the instructor's final checklist.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

You will demonstrate your knowledge of the mark series microwave ovens by diagnosing and repairing problems common to this appliance.

CONTENTS	LEARNING ACTIVITY #
Instructor's Final Checklist	5

CHECK-OUT ACTIVITY

Given a microwave oven and the necessary tools and equipment, you will check the unit and determine if all functions are operating properly. If malfunctions are found, they are to be repaired.

REFERENCES

Whirlpool Corporation, "Mastering The Mark Series Microwave Oven," Whirlpool Corporation, Benton Harbor, MI.

______________, filmstrip, "Mastering the Mark Series Microwave Oven, " Whirlpool Corporation, Benton Harbor, MI.

INSTRUCTOR'S GUIDE SHEET

DIAGNOSE AND REPAIR MARK SERIES MICROWAVE OVENS

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have the student read about microwave ovens.	Whirlpool Corporation, "Mastering The Mark Series Microwave Oven," Pages 20-31.	
2.	Have the student observe a filmstrip on the Mark Series microwave oven.	Filmstrip, "Mastering the Mark Series Microwave Oven," Whirlpool Corporation.	
3.	Have the student read the recall booklet on microwave ovens.	Whirlpool Corporation, "Mastering The Mark Series Microwave Ovens," Page 1-17.	
4.	Allow the student to practice diagnosing and repairing a microwave oven.	See tools and equipment list.	
5.	Allow the student to complete the check-out activity for this task assignment.	See tools and equipment list.	
	Evaluate the student's performance.	Instructor's Final Checklist.	

TOOLS AND EQUIPMENT

Basic appliance repair tool kit, VOM, replacement circuit boards, and switches.

INSTRUCTOR'S FINAL CHECKLIST

DIAGNOSE AND REPAIR MARK SERIES MICROWAVE OVENS

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In diagnosing and repairing a Mark Series microwave oven, the student performed the following:

	FULLY AC	NOT AC	NOT AP
1. Programmed and operated oven through all operating functions.	____	____	____
2. Followed safety procedures in accessing components of the oven.	____	____	____
3. Identified circuit board(s) or switch responsible for malfunction.	____	____	____
4. Removed and replaced defective component.	____	____	____
5. Tested oven operation.	____	____	____
6. Cleaned work area and stored tools.	____	____	____

INSTRUCTOR'S GUIDE SHEET

REPLACE MAGNETISM TUBE

OBJECTIVE

The instructord will provide a microwave oven, replacement magnetism tube, proper tools, and manufacturers repair manual. you will remove a defective magnetism tube and install a replacement. You will be evaluated according to the instructor's final checklist.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEE

You will demonstrate your ability to replace the magnetron tube in a microwave ove

CONTENTS	LEARNING ACTIVITY #
Instructor's Guide Sheet I	3
Instructor's Final Checklist	4

CHECK-OUT ACTIVITY

Your instructor will provide a microwave oven, a replacement magnetron tube, proper tools and a manufacturer's repair manual. You will install the replacement magnetron tube so that the microwave oven operates at manufacturer's specifications.

REFERENCE

Manufacturer's Repair Manual.

INSTRUCTOR'S GUIDE SHEET

REPLACE MAGNETRON TUBE

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have student read about microwave magnetron tubes.	Manufacturer's Repair Manual.	
2.	Have student observe a presentation on microwave magnetron tube replacement.		
3.	Have student practice replacing a microwave magnetron tube.	Manufacturer's Repair Manual.	
4.	Allow student to complete check-out activity listed for this task assignment.		
5.	Evaluate student performance.	Instructor's Final Checklist.	

TOOLS AND EQUIPMENT

Basic appliance repair tool kit, replacement magnetron tube, and repair manual.

INSTRUCTOR'S FINAL CHECKLIST

REPLACE MAGNETRON TUBE

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.	FULLY AC	NOT AC	NOT AP
In replacing the magnetron tube in a microwave oven, the student performed the following:			
1. Disconnected power supply.	____	____	____
2. Removed the cabinet.	____	____	____
3. Drained the capacitor.	____	____	____
4. Removed and replaced the magnetron tube.	____	____	____
5. Reassembled microwave oven.	____	____	____
6. Cleaned area and stored tools.	____	____	____

INSTRUCTOR'S GUIDE SHEET

INSTALL A WINDOW MOUNT AIR CONDITIONER

OBJECTIVE

Given a window mount air conditioner, tools, and equipment by the instructor, you will install the air conditioner to the manufacturer's specifications. Your performance will be rated according to the instructor's final checklist.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

You will demonstrate your ability to install a window mount air conditioner.

CONTENTS	LEARNING ACTIVITY #
Instruction Sheet I	4
Instructor's Final Checklist	5

CHECK-OUT ACTIVITY

Provide a window air conditioner, an installation kit, and the tools needed, install an air conditioning unit so that the adjustment panels are straight, no gaps show between the unit and the frame, and the unit drains properly.

REFERENCES

Meyerink, G., (1973), Appliance Service Handbook, Prentice-Hall, Inc., Englewood Cliffs, N.J.

INSTRUCTOR'S GUIDE SHEET

INSTALL A WINDOW MOUNT AIR CONDITIONER

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have the student read about window mount air conditioner installation.	Meyerink, Appliance Service Handbook, pages 63-66.	
2.	Have the student observe a demonstration on installing an air conditoner.		
3.	Have the student answer in writing the questions on window air conditioner.	Meyerink, Appliance Service Handbook, page 64.	
4.	Allow the student to practice installing a air conditoner.	Instruction Sheet I.	
5.	Allow the student to complete the check-out activity.	See tools and equipment list.	
	Evaluate the student's performance.	Instructor's Final Checklist.	

TOOLS AND EQUIPMENT

Drill and bits, assorted screwdrivers, 1/2" sockets and ratchet, hammer, level, 10" tin snips, sealing compound, VOM.

INSTRUCTOR'S FINAL CHECKLIST

INSTALL A WINDOW MOUNT AIR CONDITIONER

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In installing a window mount air conditioner, the student performed the following:	FULLY AC	NOT AC	NOT AP
1. Measured window and air conditioner for fit.			
2. Removed shipping bolts from compressor.			
3. Mounted air conditioner case in window and installed necessary braces.			
4. Installed air conditioner in case.			
5. Performed operational check.			
6. Cleaned work area and stored materials.			

INSTRUCTOR'S GUIDE SHEET

INSTALL RANGE HOOD

OBJECTIVE

Given a range hood, the proper tools, and the manufacturer's installation instructions, you will install the range hood. You will be evaluated according to the instructor's final checklist.

ATTITUDES AND VALUES TO BE DEVELOPED IN THIS TASK ASSIGNMENT SHEET

You will demonstrate your ability to install a range hood.

CONTENTS	LEARNING ACTIVITY #
Instruction Sheet I	3
Instructor's Final Checklist	4

CHECK-OUT ACTIVITY

Your instructor will provide you with a range hood, proper tools, and manufacturer's installation instructions. You will install the range hood so that it will function according to the manufacturer's specifications.

REFERENCE

Manufacturer's installation instructions.

INSTRUCTOR'S GUIDE SHEET

INSTALL RANGE HOOD

LA#	Notes and Suggestions for Instruction	References and Special Tools and Equipment	Instructor's Notes
1.	Have student read about range hood installation.	Manufacturer's installation instruction sheet.	
2.	Have student observe a demonstration on installation of range hood.		
3.	Allow the student to practice installing a range hood.	Instruction Sheet I	
4.	Allow the student to complete check-out activity.		
	Evaluate student performance.	Instructor's Final Checklist.	

TOOLS AND EQUIPMENT

Basic appliance repair tool kit, range hood, manufacturer's installation instructions.

INSTRUCTOR'S FINAL CHECKLIST

INSTALL RANGE HOOD

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In installing a range hood, the student performed the following:	FULLY AC	NOT AC	NOT AP
1. Mounted range hood above the range.	____	____	____
2. Connected electrical power supply.	____	____	____
3. Checked for proper operation.	____	____	____
4. Cleaned work area and stored tools.	____	____	____

APPLIANCE REPAIRER

INSTRUCTOR'S PACKAGE

(TASK ASSIGNMENT SHEETS APR-001 thru APR-070)

STUDENT PACKAGE

KENTUCKY DEPARTMENT OF EDUCATION
PRINTED WITH STATE FUNDS

Appliance Repairer

DEMONSTRATE KNOWLEDGE OF SAFETY PRACTICES

INTRODUCTION

Safety is an essential part of all jobs. Safety cannot be measured only by taking an examination and then forgotten, but must be measured by application of safety practices everyday. You must be safety conscious and alert to dangerous situations to prevent an accident. There are many types of safety precautions to be observed in the appliance repair classroom such as safe equipment use, safe housekeeping practices, electrical safety, and personal safety precautions.

OBJECTIVE

After studying about safety shop practices and safety rules, inspect and identify any unsafe conditons that may exist in the shop. You will complete a written test on shop safety with a score of 100%. You will be evaluated according to the instructor's final checklist.

CHECK-OUT ACTIVITY

Given a shop safety checklist, inspect the shop and record any unsafe conditions. Complete the written shop safety test provided by the instructor.

Learning Activities

1. READ the instruction sheets on shop safety.

   (or) ________________________________

2. OBSERVE the instructor demonstrate the safety procedures to be followed while in the appliance repair shop.

3. VIEW the filmstrip series Safety At Work, Prentice Hall Media.

   (or) ________________________________

4. CHECK YOUR KNOWLEDGE by completing the unit test on shop safety. Have the instructor review your answers.

5. COMPLETE the check-out activities listed for this task assignment. You will be evaluated according to the instructor's final checklist.

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INSTRUCTION SHEET I

SHOP SAFETY PRACTICES

Directions: Study and memorize the general safety practices for the APPLIANCE REPAIR SHOP which are listed below. Use this sheet to check your lab.

1. Keep all hand-tools sharp, clean, and in safe working order.
2. Report any defective tools, machines, or other equipment to the teacher.
3. Retain all guards and safety devices except with the specific authorization of the teacher.
4. Operate a hazardous machine only after all other students are clear of the machine.
5. Operate a hazardous machine only after receiving instruction on how to operate the machine safely.
6. Confine long hair before operating rotating equipment.
7. Wear appropriate eye protection whenever there is any danger from flying or falling particles or chips, radiation, glare, or hazardous substances in the work environment.
8. Wear approved respirator protection where harmful dusts or fumes exists.
9. Wear shop clothing appropriate to the instructional activity being performed.
10. Remove ties when working around machine tools or rotating equipment.
11. Remove rings and other jewelry when working in the shop.
12. Participate in no horseplay, practical jokes, or running in the shop or lab area.
13. Report all accidents to the teacher regardless of nature or severity.
14. Turn off the power before leaving a machine.
15. Make sure that all guards and barriers are in place and adjusted properly before starting a machine tool.
16. Recognize the distinctive sound of properly adjusted and smooth-running machine tool.
17. Develop a respect for machine tools and understand their purposes.
18. Use soap and water frequently as a method of preventing skin diseases.
19. Operate an internal combustion engine only if the exhaust is connected properly to an approved ventilation system.

20. Disconnect the power from machine tools before performing the maintenance tasks of oiling or cleaning.

21. Use a solvent only after determining its properties, what kind of work it does, and how to use it.

22. Put tools, repair parts, or other objects in their proper place when not in use.

23. Protect the cord of a portable electric hand tool from oil, hot or rough surfaces, and chemicals.

24. Clean the chips from a machine with a brush -- not with a rag or the bare hands.

25. Wear suitable gloves or hand pads when handling sharp, heavy, rough, or hot materials and chemicals.

26. Use metal containers for oily waste or oily rags.

27. Operate machine tools only after being sure that the footing is good.

28. Keep the shop floor clear of scraps and litter and wipe up immediately any liquids spilled on the floor.

29. When operating a machine tool, give undivided attention to the task being performed.

30. Avoid using wrenches which do not properly fit the nuts, bolts, or other objects which they are being used to turn.

31. Do not talk to or otherwise distract anyone who is operating power equipment.

INSTRUCTION SHEET II

FIRE PROCEDURES

WORKER CONTROL DURING FIRES

Directions: Read and memorize the evacuation procedures listed below; then obtain a copy of your specific shop procedures and memorize them also.

1. Most schools have an alarm system for signaling students and teachers that the building should be evacuated because of fire, gas, smoke, or impending disaster, and most states require by law that schools hold fire drills at regular intervals. Make certain that you know the fire drill regulations and the procedures to follow.

2. When the alarm is sounded for a fire drill and before you evacuate the building:

    a. Stop all activity and listen for instructions.

    b. Each piece of operating equipment should be turned off and all power disconnected at the main switch.

    c. Gas valves, torches, and portable heating equipment should be turned off.

    d. Leave the area immediately and according to the fire drill plan.

INSTRUCTION SHEET III

LIFTING HEAVY LOADS

LIFTING

Directions: "It's not what you lift but how you lift it." This statement applies to the lifting, lowering, or moving of heavy equipment or loads. Using the following procedure prescribed by the National Safety Council, the reverse procedure is followed for lowering the load. Following this sheet practice lifting a light load.

1. First make a preliminary "heft" to be sure that the load is easily within your lifting capacity. If it is not, secure help.
2. Set your feet solidly and well apart, one foot slightly ahead of the other. In some cases, it might be easier to go down almost to the floor on one knee while keeping the other leg at a 90 degree angle.
3. Crouch as close to the load as possible with legs bent at about a 90 degree angle at the knee.
4. Keep the back as straight as possible; it should not be arched.
5. Get a firm grip on the object, lifting one end slightly if necessary to get one hand under it. Grip the load so that it will not slip while you are lifting and carrying it and so that your hands will be protected.
6. To lift the object, straighten your legs, keeping your back erect and your head up.

INSTRUCTION SHEET IV

ELECTRICAL SAFETY

Directions: Study the list below; then investigate throughout the shop to try to locate unsafe conditions which might exist. Make a list and give it to your instructor if any of the conditions exists.

Unsafe practices and work procedures result in electrical accidents and fires. Some of the common unsafe acts committed in the shop are:

1. Using ungrounded equipment and portable tools or removing ground connections.
2. Using defective tools or equipment in need of repair.
3. Using equipment which does not meet the approval of the Underwriters Laboratories or other similar agencies.
4. Unsafe cleaning of electrical panels, switch boxes, motors, and other electrical equipment with water or dangerous solvents.
5. Overloading of circuits or over fusing circuits by the use of wrong size or type fuse.
6. Failure to use suitable safety equipment, gloves, rubber mats, etc. for electrical installation and repair.
7. Failure to de-energize circuits before working on equipment.
8. Improper opening and closing of switches and improper use of electrical equipment.
9. Permitting rubbish, trash, rags, etc., to accumulate near electrical equipment.
10. Work practices which damage motors, insulation, wires, or electrical accessories.
11. Disconnecting of electric cords by pulling on the cords rather than on the plug; stringing extension cords around the shop.
12. Using any electrical appliance, machine, or tool while standing in or touching water.

NOTE: Although the above list of unsafe practices is far from complete, you should be aware of the common electrical hazards and unsafe practices and be able to identify and eliminate them.

INSTRUCTION SHEET V

GOOD HOUSEKEEPING PRACTICES

Directions: Study the information below; then make a visual inspection of the shop and report any unsafe conditon to your instructor. Keep this list handy and use it often.

Good housekeeping cannot be attained by an occasional grand clean-up. The program for keeping the area clean must be one of continuous activity, and procedures must be established for checking and evaluating its effectiveness. The following are examples of good housekeeping practices:

1. The general appearance of the area is clean, orderly, and well-painted, with adequate lighting and ventilation.
2. The machinery and equipment are arranged to permit safe efficient work practices and ease in cleaning.
3. Materials and supplies are safely stacked or stored in proper places.
4. Tools and accessories are safely stored in cabinets, on racks, in or on other suitable devices.
5. Sufficient waste containers and receptacles are provided in appropriate locations and emptied frequently.
6. The working areas and work benches are clear and free of debris and other hazards.
7. Floors are clean and free from all obstructions, foreign material, or slippery substances such as water, oil, and grease. Floor surfaces are slip-resistant.
8. Aisles, traffic areas, and exits are free of materials and other debris. They are properly marked and defined.
9. All corners are clean and well-lighted, and free from waste material.
10. Combustible materials are properly disposed of or stored in approved containers.
11. Clean rags and waste are stored in metal containers, while oily rags are stored in self-closing or spring-lid metal containers.
12. All flammable liquids are stored in safety cans, and safety cans are stored in fireproof rooms or cabinets.

INSTRUCTION SHEET VI

SAFETY RULES YOU CAN LIVE BY

Directions: Study these safety rules and follow them always. Keep this list with you, and should you be in doubt about anything, look at the rules or ask your instructor for help.

1. Safety goggles must be worn when using grinders, buffers, or other machinery requiring them.
2. Clean up oil and grease spots from floor immediately.
3. Place oily and dirty shop towels in closed containers provided for that purpose.
4. Never smoke in shops.
5. Close parts-cleaning tank, gas cans, lacquer cans, oil cans, etc., after each use.
6. Horse play in the shop is prohibited at all times.
7. Report all accidents or injuries to the instructor immediately; he must complete an accident form.
8. Use extreme caution when working in and around moving machines or vehicles in the shop. An automobile that has no brakes, or a fast moving floor jack are heavy items that could cause serious accidents.
9. Always use correct tools on any job or operation in each individual shop.
10. Extreme care will be taken with any electrical equipment or work regardless of the nature.
11. Keep hands and clothing away from moving parts.
12. Do not wear rings and watches while working.

Instructor's Final Check-List

Title: DEMONSTRATE KNOWLEDGE OF SHOP SAFETY PROCEDURES

The student performed the following:

1. Checked the equipment and materials, observed and recorded all safety discrepancies. ____ ____ ____
2. Demonstrated lifting semi-heavy objects. ____ ____ ____
3. Memorized the fire drill and evacuation procedures. ____ ____ ____
4. Checked the location of fire extinguishers. ____ ____ ____
5. Checked to see if any unsafe electrical practices exist. ____ ____ ____
6. Identified all the good and abd housekeeping practices. ____ ____ ____
7. Read all specified materials. ____ ____ ____
8. Completed shop safety exams - 100%. ____ ____ ____

TASK ASSIGNMENT SHEET APR-002

Appliance Repairer

CHECK ELECTRICITY

INTRODUCTION

Electricity is a very important part of our everyday life. We depend upon electricity to heat and cool our homes, start our cars, cook our food, and supply power for our factories. It is important for you to know about electricity. You must have some understanding of basic electrical terms before you become skilled in electrical servicing and repair. In this task assignment you will develop an understanding of some very important electrical terms.

OBJECTIVE

Given a simple electrical circuit made of a battery, connecting wires, and a light bulb, demonstrate an understanding of the terms: voltage, current, resistance, source, conductor, and load by scoring 85% or higher on a written test. Your performance will be rated according to the instructor's final checklist.

CHECK-OUT ACTIVITY

Your instructor will provide you with a battery, connecting wires, and a light bulb. Explain what is meant by voltage, current, resistance, source, conductor, and load by using this circuit as an example.

Kentucky Department of Education
Alice McDonald, Superintendent of Public Instruction
1984-85

Learning Activities

1. READ Whirlpool Corporation, Basic Electricity for Appliances, pages 8-10 and 21.

   (or) ______________________________

2. OBSERVE a presentation by the instructor on basic electricity.
3. CHECK YOUR KNOWLEDGE by answering on a separate sheet of paper the questions in Student Self-Check I.
4. READ Instruction Sheet I, "Checking Electricity" and Instruction Sheet II, "Electrical Units of Measurement."
5. PRACTICE checking electricity and units of measurement on equipment.
6. COMPLETE the check-out activities listed for this task assignment. Your performance will be rated according to the instructor's final checklist.

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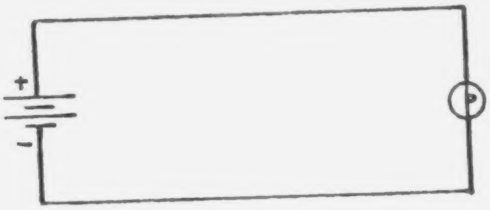
Student Self-Check I

CHECKING ELECTRICITY

On a separate sheet of paper, answer the following questions.

1. What electrical term represents the force that causes electrical current to flow?
2. What electrical term is used to represent the opposition to current flow through a conductor?
3. What electrical term is used to represent the amount of electron movement through a conductor.
4. What electrical unit is used to represent the work accomplished due to current flow?
5. How are amps connected to milliamps.
6. How are volts connected to kilovolts?
7. How many milleamps would equal .000078 amps?
8. Convert 1.2 megaohms to ohms.
9. Identify the: (1) source, (2) conductor, and (3) load of the circuit shown below:



Instruction Sheet I

CHECKING ELECTRICITY

MATERIALS:

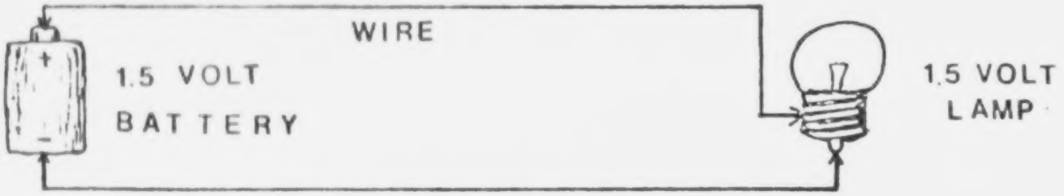
(1) Battery - 1.5 volt
(2) Lamp (with socket) - 1.5 volt
(3) Connecting wires

PROCEDURE:

1. There are three electrical terms which should be understood by any one doing electrical work. These terms are voltage, current, and resistance.

2. Obtain a flashlight battery. Notice that the battery is marked "1.5 volts" or "1½ volts." This battery is a source of voltage. It is capable of suppling electrical energy to a lamp connected to it. The voltage which a battery supplies can be thought of as electrical pressure. Notice that the battery has a positive (+) side and a negative (-) side.

3. For the battery to supply electrical pressure, a circuit must be built. Construct the circuit shown below.



4. A circuit, in its simplest form has a source, a conductor, and a load. The battery is the source of voltage (electrical pressure). the conductor is a path for electrical pressure to pass to the lamp. The lamp is called a load. The load of a circuit changes electrical energy to light energy. When the source, conductor, and load are connected together, a complete circuit is made.

5. When the circuit is connected, a current will flow. Current flows because of the electrical pressure produced by the battery. Electrical current is the movement of tiny charged particles called electrons through a conductor. Electrons have a negative charge. They move from the negative (-) side of the battery through the lamp and back to the positive (+) side of the battery.

Instruction Sheet I (page 2)

6. The amount of current that flows through a circuit depends on the resistance of the cirucit. The lamp offers resistance to the current flow. Resistance is opposition to the flow of electrical current. More resistance in a circuit causes less current to flow.

7. Look at the small wire inside the lamp. This wire is called a filament. The filament offers resistance to current flow.

8. Return all materials to their proper storage area.

Instruction Sheet II

ELECTRICAL UNITS OF MEASUREMENTS

MATERIALS: None

PROCEDURE:

1. There are four electrical units which must be understood by anyone who does electrical work. These units are defined in the chart below. Refer to this chart when you make measurements.

Unit	Meaning of Unit	Abbreviation
Voltage	Force that causes electrical current to flow through a conductor.	V
Current	Movement of charged particles called electrons through a conductor.	A
Resistance	Opposition to the flow of current.	Ω
Power	Work accomplished due to current flow through a conductor.	W

2. Often, when making electrical measurements, the term used for a measurement is less than one. Examples of measurements less than one -.5 volts, .010 amps, and .1 watts. When this occurs, certain prefixes are put before the unit of measurement. Prefixes make the small numbers easier to understand. Some common prefixes used for electrical measurements are defined in the chart on the following page. Refer to this chart for measurements you will make in future activities.

Instruction Sheet II (page 2)

Chart for Electrical Measurement

Volt

1 megavolt (1,000,000 volts) = 1 megav
1 kilovolt (1000 volts) = 1 kv
1 volt = 1 v
1 millivolt (1/1000 volt) = 1 mv
1 microvolt (1/1,000,000 volt) = 1 v

Amp

1 ampere = 1a
1 milliampere (1/1000 ampere) = 1 ma
1 microamp (1/1,000,000 amp) = 1 a

Ohm

1 ohm = 1
1 kilohm (1000 ohms) = 1 k
1 megohm (1,000,000 ohms) = 1 meg

Watt

1 watt = 1 w
1 kilowatt (1000 watts) = 1 kw
1 megawatt (1,000,000 watts) = 1 megaw
1 milliwatt (1/1000 watt) = 1 mw
1 microwatt (1/1,000,000 watt) = 1 w

3. Convert the following voltage units into units with a prefix:
    1. 1,000,000 volts
    2. 7,000 volts
    3. .0009 volts

4. Convert the following amperage units into units with a prefix:
    1. .0003 amperes
    2. .000006 amperes
    3. .001 amperes

5. Convert the following ohms units into units with a prefix:
    1. 3,000 ohms
    2. 14,000,000 ohms
    3. 9,000 ohms

6. Convert the following wattage units into units with a prefix:
    1. .0004 watts
    2. 9,000,000 watts
    3. .0000002 watts

Instruction Sheet II (page 3)

7. Convert the following electrical units to units with a prefix.

(1) .100 volts converted to millivolts = ______________
(2) .0002 volts converted to microvolts = ______________
(3) .025 volts converted to millivolts = ______________
(4) .036 amperes converted to milliamps = ______________
(5) .00000068 amperes converted to nano amperes = ____________
(6) .0000892 amperes converted to micro amperes = ____________
(7) .300 watts converted to milliwatts = ______________
(8) .000004 watts converted to microwatts = ______________
(9) .000729 watts converted to milliwatts = ______________
(10) 1.0 volts converted to millivolts = ________________

8. Many times an electrical unit with a prefix must be converted back to its original unit. For example, millivolts sometimes must be converted back to volts. When a unit with a prefix is converted back to its original unit, the unit with a prefix must be multipled by the fractional part of one of that prefix. For example, 59 millivolts converted to volts equal .059 volts because 59 millivolts multipled by the fractional part of one unit (.001 for the prefix milli) equals .059 volts (59 × .001 = .059V).

9. An easier way to remember how to convert a unit with a prefix back into the original electrical unit is to remember the following statement:

> "When changing an electrical unit with a prefix back into its original unit, move the decimal in the unit with a prefix to the left the same number of places that the prefix represents."

10. For example, changing 225 millivolts back to volts causes the decimal point in 225 to be moved three places to the left (.225). This is because the prefix "milli" has three decimal places. So, 225mV equals .225 volts. This same method can be used when changing any electrical unit with a prefix to the original electrical unit.

11. Convert the following electrical units with prefixes to their original electrical units:

(1) 369 mV changed to volts = ___________V
(2) 46 uV changed to volts = ____________V
(3) 5 mA changed to amperes = ____________A
(4) 10 nA changed to amperes = ____________A
(5) 122 uA changed to amperes = ____________A
(6) 4.6 mV changed to volts = ______________V
(7) 520 uW changed to watts = ______________W
(8) 792 nW changed to watts = ______________W
(9) 16 mA changed to amperes = _____________A
(10) 1 uW changed to watts = ________________W

Instruction Sheet II (page 4)

12. Sometimes an electrical unit of measurement is very large such as: 10,000,000 watts, 47,000 ohms, or 77,000 volts. When this occurs, prefixes are used to make using these large numbers easier. These prefixes are used for electrical value, many times larger than the electrical unit. Some of these prefixes are defined in the chart below.

Prefix	Number of Times Larger than one Unit	Abbreviation
Giga	1,000,000,000; 9 decimal places	G
Mega	1,000,000; 6 decimal places	M
Kilo	1,000; 3 decimal places	K

13. To change any large value to a smaller unit, you divide the large unit by the number value of the prefix. For example, 18,000,000 Ohms could be changed to 18 megohms by dividing 18,000,000 by 1,000,000. 1,000,000 is the number represented by the prefix mega (18,000,000 - 1,000,000 = 18 megohms). We could convert 7,000 volts into 7 kilovolts by the same methods (7,000 - 1,000 = 7 KV).

14. You can see from the above examples that to change a large unit to a unit with a prefix, you move the decimal point in the large unit to the left the number of zeros which the prefix has. For example, 6,800 volts changed to kilovolts causes the decimal point in 6,800 to be moved three places to the left. This is because the prefix kilo has three zeros. So, 6,800 volts equal 6.8 KV because of the movement of the decimal point (6,800).

15. To convert all electrical units with a prefix back to larger number, the decimal point is moved to the right the same number of places used in the original unit. The unit may also be multiplied by the number represented by the prefix.

16. If 10 megohms is converted to ohms, the decimal point is moved six places to the right (10.000000). Also, 10 megohms could be multiplied by the number represented by the prefix (1,000,000). 10 megohms X 1,000,000 = 10,000,000 ohms.

Instruction Sheet II (page 5)

17. Convert the following electrical units:

(1) 1,000 ohms to kilohms = ______________ KΩ
(2) 27,000 ohms to kilohms = ______________ kΩ
(3) 3.3 K to ohms = ______________ ohms
(4) .47 megohm to ohms = ______________ Ω
(5) 1.5 megohm to ohms = ______________ Ω
(6) 12,000,000 ohms to megohms ______________ MΩ
(7) 2 KV to volts = ______________ V
(8) 1,000,000 volts to kilovolts = ______________ KV
(9) 1 mega watt to watts = ______________ W
(10) 15 KW to watts = ______________ W
(11) 3,000,000 watts to megawatts = ______________ MW
(12) 6.3 KW to watts = ______________ W

18. This activity will be helpful when doing other activities which deal with electrical measurement.

Instructor's Final Checklist

CHECK ELECTRICITY

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

	FULLY AC	NOT AC	NOT AP
While checking electricity and applying the terms of electricity, the student:			
1. Selected the proper materials.	___	___	___
2. Constructed the circuit properly.	___	___	___

Appliance Repairer

IDENTIFY PROPERTIES OF D.C. ELECTRICAL CIRCUITS

INTRODUCTION

In order to safely perform electrical circuit maintenance, facts concerning the physical and electrical properties of the circuit must be determined. In this task assignment you will learn to identify the properties of D.C. electrical circuits.

OBJECTIVE

1. Identify on a schematic diagram the three physical properties basic to an electrical circuit.
2. Identify the electrical properties which are basic to a functioning electrical circuit.
3. Measure the current flow in a D.C. circuit.

You will be rated according to the instructor's final checklist.

CHECK-OUT ACTIVITY

Your instructor will provide you with a list of incomplete statements related to identifying the properties of D.C. electrical circuits and a list of terms, phrases, and numbers; select from the list of terms , phrases, and numbers the one that best completes each statement.

Your instructor will provide you with a schematic diagram of a simple D.C. circuit and the necessary components and meter, construct the circuit and measure the value of the current flow.

Learning Activities

1. READ Meyerink, G., Appliance Service Handbook, pages 96-105.

   (or) ____________________

2. OBSERVE a presentation by the instructor on D.C. electrical circuits.
3. CHECK YOUR KNOWLEDGE by completing Student Self-Check I, "Identifying Properties of D.C. Electrical Circuits."
4. PRACTICE measuring current flow by completing Instruction Sheet I, "Measuring Current Flow."
5. ARRANGE with your instructor to complete the Check-Out Activities listed for this task assignment.

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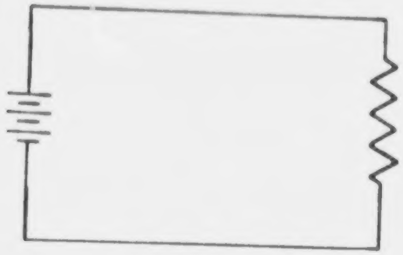
INSTRUCTION SHEET I

MEASURING CURRENT FLOW

Student's Name ____________________ Date ____________

Construct the circuit illustrated below and measure the current flow using a volt-ohm-milliampere (VOM) meter. Your instructor will provide you with the necessary components and meter.



Student Self-Check I

IDENTIFY PROPERTIES OF D.C. ELECTRICAL CIRCUITS

Select from the list below the term, phrase or number that best completes each of the following incomplete statements. Write the letter of your choice in the space provided.

a. amperes
b. positive to negative
c. atom
d. negative to positive
e. ohms
f. power source
g. parallel
h. matter
i. electrostatic force
j. proton
k. compound
l. series
m. load
n. 20
o. electromotive force
p. 29
q. Jones

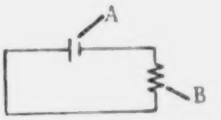
_____ 1. Anything which has weight and occupies space is referred to as _______________.

_____ 2. A substance of two or more elements is called a __________.

_____ 3. The smallest particle into which an element can be divided is called a (an) ____________.

_____ 4. The physical property of the circuit below indicated by the letter "A" is a ______________ device.

_____ 5. The physical property of the circuit below indicated by the letter "B" is a ______________ device.



_____ 6. Copper is a good conductor of electricity. The number of electrons is an atom of copper is _______________.

_____ 7. Electrical voltage may be defined as ___________.

_____ 8. The rate at which electrons move past a given point in a circuit is measured in _______________.

_____ 9. The direction of electron flow in an electrical circuit is __________ to ___________.

Student Self-Check I (page 2)

_____ 10. The basic law governing the flow of electricity is called __________.

_____ 11. When measuring current in an electrical circuit the ammeter is connected in ____________ with the current path.

_____ 12. The negative charge of the electron is attracted by the positive charge of the proton. This force of attraction is called an (a) _____________.

Instructor's Final Checklist

IDENTIFYING PROPERTIES OF D.C. ELECTRICAL CIRCUITS

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In identifying properties of D.C. electrical circuits, the student:	FULLY AC	NOT AC	NOT AP
1. Constructed the circuit according to the schematic diagram.	___	___	___
2. Determined the direction of current flow in the circuit.	___	___	___
3. Connected the meter in series with current path.	___	___	___
4. Set the meter on the correct scale.	___	___	___
5. Read the meter correctly.	___	___	___

Appliance Repairer

DEFINE ELECTRICAL QUANTITIES

INTRODUCTION

There exists a mathematical relationship among the electrical quantities of an electrical circuit. When troubleshooting an electrical circuit it is necessary that the technician define this relationship. In this task assignment you will learn to define electrical quantities.

OBJECTIVE

1. Define voltage or electromotive force and determine voltage in a D.C. circuit.
2. Identify the characteristics of resistance and determine resistance in a D.C. circuit.
3. Identify Ohm's Law and apply Ohm's Law in defining the quantities in a D.C. circuit.

CHECK-OUT ACTIVITY

Your instructor will provide you with a list of incomplete statements related to defining electrical quantities and a list of terms, phrases, and numbers; select from the list of terms, phrases, and numbers the one that best completes each statement.

Learning Activities

1. READ Meyerink, G., Appliance Service Handbook, pages 96-105.
2. OBSERVE a lecture by the instructor on (1) voltage, (2) resistance, and (3) Ohm's Law.
3. CHECK YOUR KNOWLEDGE by completing Student Self Check I, II, and III. Have the intructor check your answer sheets.
4. COMPLETE the check-out activity listed for this task assignment. You will be rated according to the instructor's final check-list.

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Student Self-Check I

VOLTAGE

Select from the list below the word or phrase that best completes each of the following statements. Write the letter of your choice in the space provided.

A. pressure
B. joule
C. series aiding
D. electrons
E. series parallel
F. movement
G. secondary
H. magnitude
I. chemical
J. electromotive force
K. series opposing
L. potential
M. fire
N. friction
O. parallel
P. electrolyte
Q. ground
R. Photoelectric
S. sulfuric acid
T. emf
U. voltage rise

_____ 1. One of the names given for force that causes electrons to move is _____________.

_____ 2. A volt represents one _____________ of energy (or work) per Coulomb of charge.

_____ 3. Emf can be thought of as a potential for producing the movement of ______________.

_____ 4. _____________ difference describes the characteristics of electromotive force in an open circuit.

_____ 5. It is more important to consider the difference between two charges rather than the _____________ of a charge.

_____ 6. In a solar cell emf is produced by using the _________ effect to produce voltage.

_____ 7. The solution which reacts with the positive and negative metal electrodes in a battery is called ______________.

_____ 8. In addition to a magnetic field and a conductor there must be relative _________________ between them.

_____ 9. The oldest method known for producing electricity is by __________.

_____ 10. A small electrical charge can be developed by the piezoelectric effect. This is accomplished by applying _______________ to a surface of the object.

_____ 11. Emf can be produced by light, heat, magnetism, pressure, and chemical activity and __________________ can produce light, magnetism, heat, chemical activity, and pressure.

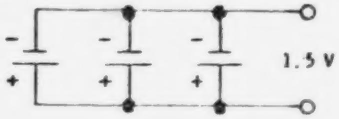
_____ 12. The release of energy in a battery or cell is first stored in a _____________ form.

Student Self-Check I (page 2)

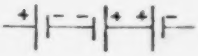
_____ 13. The _____________ cell can be recharged and the primary cell cannot be recharged.

_____ 14. Lead-sulfate when recharged converts to _____________.

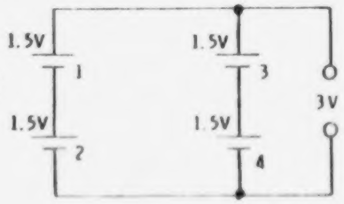
_____ 15. Name this circuit connection.



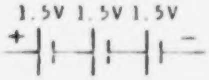
_____ 16. Name this circuit connection.



_____ 17. Name this circuit connection.



_____ 18. Name this circuit connection.



_____ 19. In a circuit in which current is flowing the sum of the voltage drop equals the sum of the _________________.

_____ 20. Using the formula $v = \frac{J}{C}$, determine V, if J is 20 and C is 4. = _______________.

_____ 21. Generally _____________ in a small electronic piece of equipment is simply a zero reference point.

Student Self-Check II

DEFINING RESISTANCE

Select from the list below the word or phrase that best completes each of the following statements. Write the letter of your choice in the space provided.

A. twenty
B. resistivity
C. ten
D. 1 megohm's
E. sixty
F. thirteen
G. tolerance
H. ohm's
I. nickle-chromium
J. carbon-composition
K. free
L. six
M. value
N. decrease
O. variable
P. resistance

_____ 1. In order for current to flow, electrons must be ______ to move.

_____ 2. Define this term, one m _______.

_____ 3. George Simon Ohm, a German physicist discovered the relationship between voltage, current, and resistance which is measured in ________________.

_____ 4. It is the ____________ of a material which determines if the material is a conductor or an insulator.

_____ 5. A resistor is designed to introduce a specific amount of ___________ into a circuit.

_____ 6. In a wire wound resistor you will generally find _________ wire.

_____ 7. The most common resistor used today is _______________.

_____ 8. The color bands on a resistor tells the _____________ of a resistor.

_____ 9. Just by looking at a resistor we can determine resistance, wattage and _______________.

_____ 10. Potentiometers, rheostats, and slide-wire resistors are examples of _____________ resistors.

_____ 11. Three 20 ohm resistors in series have the same opposition to current flow as a single ________________ ohm resistor.

Student Self-Check II (page 2)

_____ 12. In a series circuit having 4 resistors, 2 each at 3 ohm's and the other two at 7 ohm's what is the total value of the resistors in this circuit.

_____ 13. In a parallel circuit using two resistors, one at 15 and one at 10 ohms, the resistance total (R_T) of this parallel circuits is _______________.

_____ 14. In a parallel circuit using three resistors each being 30 ohms of resistance, the total resistance of this circuit _______________.

_____ 15. In a series-parallel circuit, two resistors in parallel are 10 ohms, and in the series circuit two resistors are 4 ohms each, the total value of the resistors in this circuit is _______________.

Student Self-Check III

APPLYING OHM'S LAW

Select from the list below the word or phrase that best completes each of the following statements. Write the letter of your choice in the space provided.

a. Twenty
b. Megohm's
c. Four
d. Volts
e. $E = IR$

f. Fifty
g. Sixteen
h. $I = \frac{E}{R}$
i. Ten
j. Relationship

k. Voltage
l. Current
m. Eight
n. Power
o. Twelve

_____ 1. Ohm's Law defined the ____________ between the three fundamental electrical quantities of current, voltage, and resistance.

_____ 2. In electrical circuits symbols are normally used to represent different quantities, i.e., R represents resistance, I current and E __________.

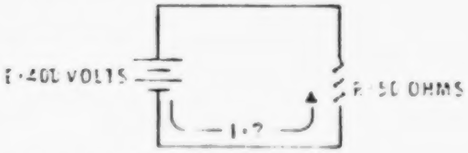
_____ 3. When the emf is given in volts and the current is given in microamperes, then resistance is given in __________.

_____ 4. What size resistor develops a voltage drop of 24 volts when a current of 1.75 amperes flow through it? _______

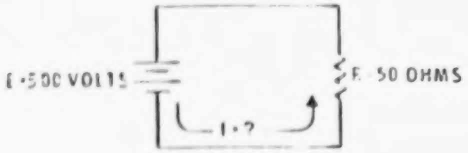
_____ 5. If current is given in milliamperes and resistance is given in kilohms, then emf will be given in __________.

_____ 6. Using $E = IR$, determine the voltage drop across a 24 ohm resistor when the current through the resistor is 5 amps. ____________

_____ 7. Determine amperes in this diagram.

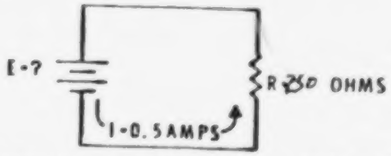


_____ 8. Determine amperes in this diagram.



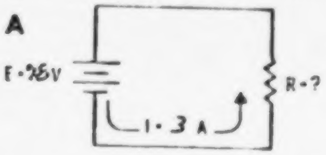
Student Self-Check III (page 3)

_____ 9. Determine voltage in this diagram.


E-?
R-250 OHMS
I-0.5AMPS

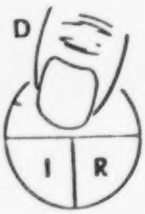
250 OHMS

_____ 10. Determine resistance in this diagram.

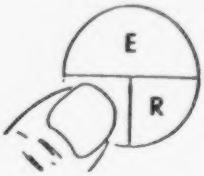


48 V
3 A

_____ 11. Using Ohm's Law define what this figure represents.

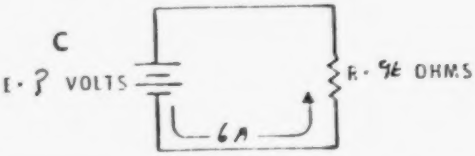


_____ 12. Using Ohm's Law define what this figure represents.



_____ 13. In addition to current, resistance and voltage, another important electrical quantity is _____________.

_____ 14. Determine voltage in this diagram.


C
E-? VOLTS
R-96 OHMS
6A

_____ 15. Power is directly proportional to both voltage and _______________.

INSTRUCTOR'S FINAL CHECKLIST

DEFINING ELECTRICAL QUANTITIES

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

The Student:

	FULLY AC	NOT AC	NOT AP
1. Identified the different terms for voltage.	____	____	____
2. Identified a unit of charge.	____	____	____
3. Identified the changability of a secondary cell.	____	____	____
4. Determined how to connect two cells to double the voltage.	____	____	____
5. Determined when it is to possible to determine voltage drop in a circuit.	____	____	____
6. Identified the voltage drop of two identical resistors, as well as well as different resistors in series.	____	____	____
&. Identified the proper hook up and a volt meter to measure voltage drop.	____	____	____
*. Identified the moving force of an electrical circuit.	____	____	____
9. Identified resistivity.	____	____	____
10. Identified the different aspects of a length of wire that affect resistance.	____	____	____
11. Identified resistance in relation to the cross sectional area.	____	____	____

12. Identified resistance in relation to temperature coefficient. _____ _____ _____

13. Identified the color bands on a resistor. _____ _____ _____

14. Determined R_T of a circuit with a resistor. _____ _____ _____

15. Identified the proper hook up of an ohmmeter with two resistors in a circuit. _____ _____ _____

16. Identified Ohm's Law in regard to current. _____ _____ _____

17. Identified the desired resistance in an ammeter. _____ _____ _____

18. Identified the proper wattage of dissipated power. _____ _____ _____

19. Determine resistance value. _____ _____ _____

Appliance Repairer

USE A VOM TO MEASURE ELECTRICAL QUANTITIES

INTRODUCTION

The field of appliance repair technician is a career that requires you to know how to make various electrical measurements. Upon completion of this module you will be able to use a volt-ohm-milliameter (VOM) to make the electrical measurements of current, voltage, and resistance.

OBJECTIVE

1. Determine the value of electrical quantities in a simple D.C. circuit
2. Measure electrical quantities in a simple D.C. circuit using a volt ohmmeter (VOM)

You will be rated according to the instructor's final checklist.

CHECK-OUT ACTIVITY

Your instructor will provide you with a list of questions relating to determining and measuring electrical quantities with a VOM. Using what you have learned in this task assignment, answer the questions with an accuracy of at least 85%.

Learning Activities

1. READ Meyerink, G., Appliance Service Handbook, pages 96-116.
2. OBSERVE the instructor demonstrate the use of a VOM.
3. CHECK YOUR KNOWLEDGE by completing Student Self-Check I, "Electrical Measurements."
4. PRACTICE using a VOM to measure electrical quantities.
5. COMPLETE the check-out activity listed for this task assignment. You will be rated according to the instructor's final checklist.

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Student Self-Check I

ELECTRICAL MEASUREMENTS

Select from the list below the word or phrase that best completes each of the following statements. Write the letter of your choice in the space provided.

A. current
B. compensate
C. spiral
D. series
E. high
F. limit
G. taut-band
H. shunt
I. bands
J. multiplier
K. d'Arsonval
L. transistors
M. right
N. E = IR
O. R =
P. half-scale
Q. soft-iron
R. ohmmeter

_____ 1. The permanent-magnetic, moving-coil meter movement is defined as a ______________ movement.

_____ 2. A variation of the movement in question no. 1 uses thin metal ______________ to replace the pivots, jeweled bearings, and spiral springs.

_____ 3. The meter movement in question no. 2 is called a ____________ type.

_____ 4. Pole pieces and a ___________ core are used to concentrate the magnetic field in the air gap through which the moving-coil rotates.

_____ 5. Two ___________ springs are used to return the pointer to the zero position when no current flows through the coil.

_____ 6. In a taut-band movement, less ____________ is required to cause full scale deflection.

_____ 7. The current range of the ammeter can be extended by placing a resistor, called a _______________, in parallel with the meter movement.

_____ 8. The ammeter must always be connected in ______________ with the circuit under test.

_____ 9. Using this formula ____________, we find the voltage drop of the diagram shown below to be 0.09 volts.

_____ 10. Using this formula __________ we can complete the resistance of the shunt in any circuit.

_____ 11. In the voltmeter, the range is extended by adding a resistor in parallel with the meter movement. This resistor is called a ______________ resistor.

Student Self-Check I (page 2)

_____ 12. The purpose of the multiplier is to _____________ the current to the full-scale current rating of the meter movement.

_____ 13. Using the proper value of shunt, the ____________ point can indicate 900 ohms instead of 90,000 ohms.

_____ 14. In a series voltmeter, 0 appears on the _____________ side of the scale.

_____ 15. The zero ohms adjustments purpose is to ______________ for different values of battery voltage.

_____ 16. The multimeter is normally made up of the voltmeter ___________ and current motor.

_____ 17. Some multimeters have ___________ or vacuum-tubes in addition to the meter movement circuits.

_____ 18. The advantage of the electronic meter is that it has a very ____________ resistance.

INSTRUCTOR'S FINAL CHECKLIST

USE A VOM TO MEASURE ELECTRICAL QUANTITIES

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

	FULLY AC	NOT AC	NOT AP
1. The student identified the meter movement which rotates in the field of a permanent magnet.	____	____	____
2. The student identified the bearings used in the taunt band meter movement.	____	____	____
3. The student identified the meter when the range is increased by placing a resistor in parallel with the meter movement.	____	____	____
4. The student identified the meter when the range is increased by placing a higher value dropping resistor in series with the meter movement.	____	____	____
5. The student identified the accuracy of a meter and its deflection.	____	____	____
6. The student determined how to minimize the loading effect of a voltmeter.	____	____	____
7. The student identified the effect of modification to lower values of resistance.	____	____	____
8. The student identified the half-scale reading of a given ohmmeter.	____	____	____
9. The student identified the sensitivity of the meter movement on a designated multimeter.	____	____	____

10. The student identified the value of resistance 6 in a designated multimeter diagram. ____ ____ ____

11. The student identified the voltage of battery in a designated multimeter. ____ ____ ____

12. The student identified the value of resistor 1 in a designated multimter diagram. ____ ____ ____

Appliance Repairer

MEASURE RESISTANCE

INTRODUCTION

Many important electrical tests may be made by measuring resistance. Resistance is opposition to the flow of current in an electrical circuit. The amount of current which flows in a circuit depends upon the amount of resistance in that circuit. In this task assignment you will learn to measure resistance in an electrical circuit by use of a meter.

OBJECTIVE

Your instructor will provide you with several components and a meter. Use the meter to measure accurately the resistance of the components. You will be rated according to the instructor's final checklist.

CHECK-OUT ACTIVITY

Given various components and a VOM, measure the resistance value of each components. Readings must agree with those provided by the instructor.

Learning Activities

1. READ Whirlpool Corporation, Basic Electricity for Appliances, page 26, 28-31 and 83-86.

   (or) ______________________________

2. READ Instruction Sheet I, "Resistor Color Coding."
3. PRACTICE the use of color coding by completing Student Self-Check I, "Resistor Color Coding."
4. READ Instruction Sheet II, "Measuring Resistance."
5. PRACTICE measuring resistance on a unit provided by the instructor.
6. CHECK YOUR KNOWLEDGE by completing Student Self-Check II, "Measuring Resistance."
7. COMPLETE the Check-Out Activities listed for this task assignment. You will be rated according to the instructor's final checklist.

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Instruction Sheet I

RESISTOR COLOR CODING

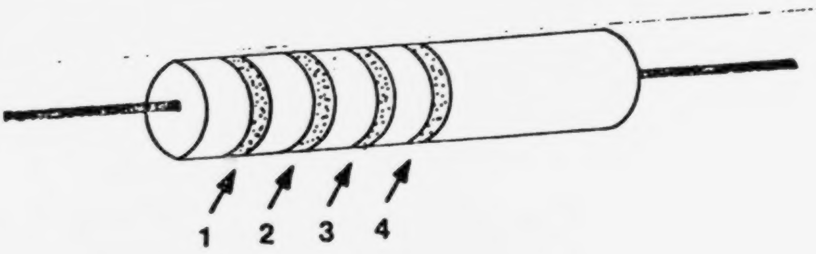
MATERIALS:

Assorted color coded resistors (5)

PROCEDURE:

1. The most important thing to learn when working with color coded resistors is the meaning of the colors on the resistor. Below is a diagram of a resistor which has the color band system of identification.

COLOR CODED RESISTOR



COLOR BAND LOCATION

2. This color coding method used twelve basic colors to mark the value of a resistor. The first color indicates the first digit in the value of the resistor. Remember, resistance is measured in ohms. The second color indicates the second digit in the value of the resistor. The third color indicated the number by which the first two digits are to be multiplied or the number of zeros to be added to the first two numbers. The fourth color, if there is a fourth color, indicated the amount of tolerance of the marked value of the resistor.

3. The tolerance of a resistor is the amount that it can vary (plus or minus) from its marked value and still be considered good. Tolerance is usually expressed at ±5, ±10, or ±20% of the resistor's marked value (in ohms).

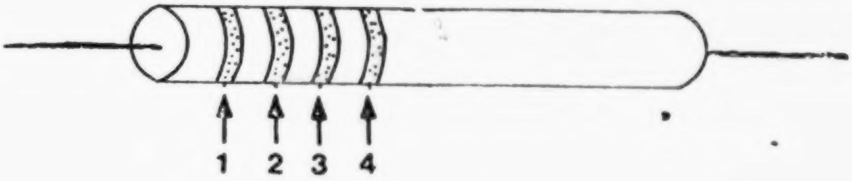
Instruction Sheet I (page 2)

4. The following chart summarizes the twelve colors normally used with resistor color codes.

COLOR	FIRST COLOR FIRST DIGIT	SECOND COLOR SECOND DIGIT	THIRD COLOR		FOURTH COLOR TOLERANCE
			Multiplier	Number of Zeros	
Black	0	0	1	0	—
Brown	1	1	10	1	—
Red	2	2	100	2	—
Orange	3	3	1,000	3	—
Yellow	4	4	10,000	4	—
Green	5	5	100,000	5	—
Blue	6	6	1,000,000	6	—
Violet	7	7	10,000,000	7	—
Gray	8	8	100,000,000	8	—
White	9	9	—	—	—
Gold	—	—	—	—	±5%
Silver	—	—	—	—	±10%
No Color	—	—	—	—	±20%

Instruction Sheet I (page 3)

5. The drawing below is that of a resistor which uses the band color coding method. Read the colors from the end of the resistor closest to the bands. Using the chart, you should be able to determine the value of the resistor in ohms and its tolerance.



1. BROWN 2. BLACK 3. ORANGE 4. GOLD

6. The first color is brown, which indicates the first digit in the value of the resistor to be 1.

7. The second color is black which indicates the second digit in the value of the resistor to be 0. We now have the first two digits of the value of the resistor 10.

8. The third color is orange, which indicates the number by which the first two digits are to be multiplied or the number of zeros to add to the first two digits. The first two digits are 1 and 0. Since the color, orange, is a multiplier of 1,000, we can multiply 10 X 1,000 which will give us the value in ohms of the resistor (10 X 1,000 = 10,000 ohms). Orange also indicates that we must add three zeros to our first two digits to determine the value of the resistor (0 with three zeros added equals 10,000 ohms). Use the method you like best to determine the resistance value of color codes resistors.

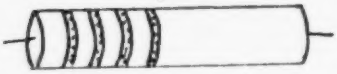
9. The fourth color is gold, which indicates the tolerance of the resistor. The tolerance indicates how close the measured value of the resistor should be to the marked value. Tolerance is expressed as a percent of the marked value. In this case, gold indicates a tolerance of ±5%. This means that the resistor must be within 5% of 10,000 ohms, one way or another. Thus, the value of the resistor shown could be as low as 9,500 ohms (10,000 X .05 = 500; 10,000 - 500 = 9,500) or as high as 10,500 (10,000 X .05 = 500; 10,000 + 500 = 10,500).

10. Sometimes there will be no fourth color on the resistor. When this occurs, the tolerance is 20%.

11. In the space below, the values of some resistors and their tolerances are shown.

Instruction Sheet I (page 3)

1



1. BROWN
2. RED
3. GREEN
4. SILVER

2

1. ORANGE
2. BLACK
3. BLUE
4. GOLD

3

1. YELLOW
2. VIOLET
3. RED

#1 - 1,200,000 ± 10%

#2 - 30,000,000 ± 5%

#3 - 4,700 ± 20%

12. By now you should be able to find the resistance value and tolerance of any color codes resistor by using the chart. Without the chart, you might be helpless. Another way of determining the value of any color coded resistor is to remember the following statements: "Brings Better Results Once You've Gained By Very Good Work."

The first letter of each word in the preceeding statement corresponds with the first letter of each of the twelve colors used in the color code. The words of the statment may be counted, beginning with zero (0), to determine which word corresponds with the number of zeros to be added to complete the resistor's value. For example:

Brings	Better	Results	Once	You've	Gained	By	Very	Good	Work
black	brown	red	orange	yellow	green	blue	violet	gray	white

13. Return all materials to their proper storage area.

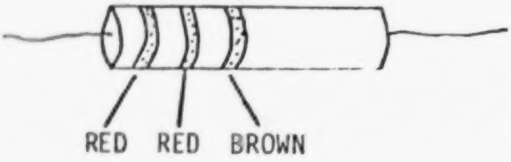
Student Self-Check I

RESISTOR COLOR CODING

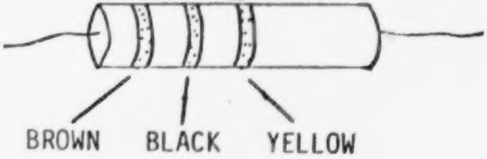
Answer each of the following questions. Then check your answers with those at the bottom of the page.

1. Practice by determining the values of the following resistors:

#1



#2



#1 ____________ #2 ____________

2. In the spaces below, list in order, the color bands of each of the five resistors supplied by your instructor. After listing the colors, record the value and tolerance of each resistor.

Example:

brown,	black,	black,	gold,	____ ohms,	5 %
1. ____,	____,	____,	____,	____ ohms,	____ %
2. ____,	____,	____,	____,	____ ohms,	____ %
3. ____,	____,	____,	____,	____ ohms,	____ %
4. ____,	____,	____,	____,	____ ohms,	____ %
5. ____,	____,	____,	____,	____ ohms,	____ %

Answers

1. #1 ____________ #2 ____________

2. See Instructor's Manual

Instruction Sheet II

MEASURING RESISTANCE

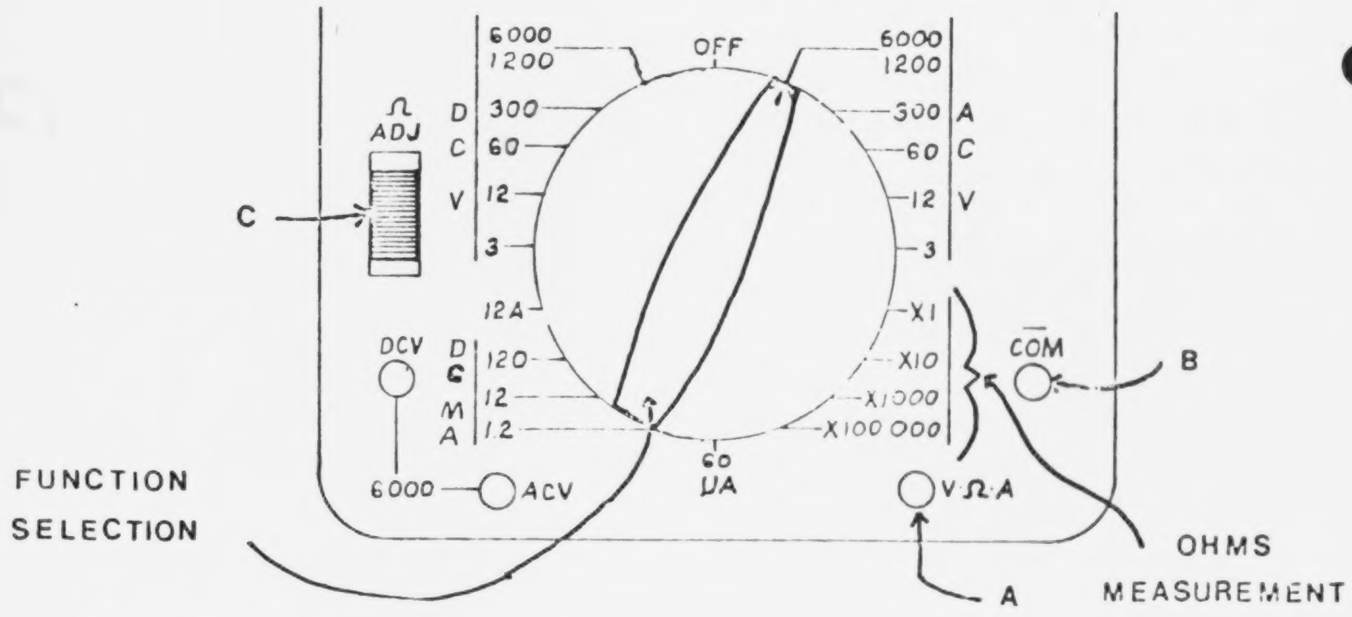
MATERIALS:

1. Volt-Ohm Milliammeter (VOM)
2. Potentiometer (5K Ohm)
3. Resistors (10, 33, 220, 470, 1,000, 5.6K, 100K, 500K, 1 Meg. Ohm)

PROCEDURE:

1. Obtain a VOM.

2. The VOM is one of the most used meters for doing electrical work. A VOM can be used to measure resistance voltage, or current. The type of measurement can be changed by adjusting the "function selection switch" to be desired measurement. Shown below are the controls of a common type of VOM.



Ω ADJ
C
D C V
6000
1200
300
60
12
3
12A
OFF
6000
1200
300
60
12
3
A C V
X1
X10
X1000
X100 000
COM
B
DCV
D C M A
120
12
1.2
6000
ACV
60 μA
V·Ω·A
A
FUNCTION SELECTION
OHMS MEASUREMENT

Instruction Sheet II (page 2)

3. You will notice that the function selection switch is in the center of some circular division. It acts as a rotary dial. You will also notice that part of the circular divisions are for measuring ohms or resistance. The ohms measurement division are divided into four portions: X1, X10, X1,000, and X100,000. The meter that you are using may be slightly different from the one shown, but most VOM's are very similar.

4. Adjust the function selection switch on your meter to any of the divisions in the ohms of the meter. Notice the different positions in the ohms measurement section on your meter.

5. Now that you have adjusted the VOM to the ohms section, put the test leads into the meter so that you can measure resistance. The test leads used with the VOM are, ordinarily, black and red. These colors are used to help you know whch lead is the positive or negative side of the meter. This is important when measuring direct current (DC) values. For your purpose, red will indicate the positive polarity (+) and black will indicate the negative (-) polarity.

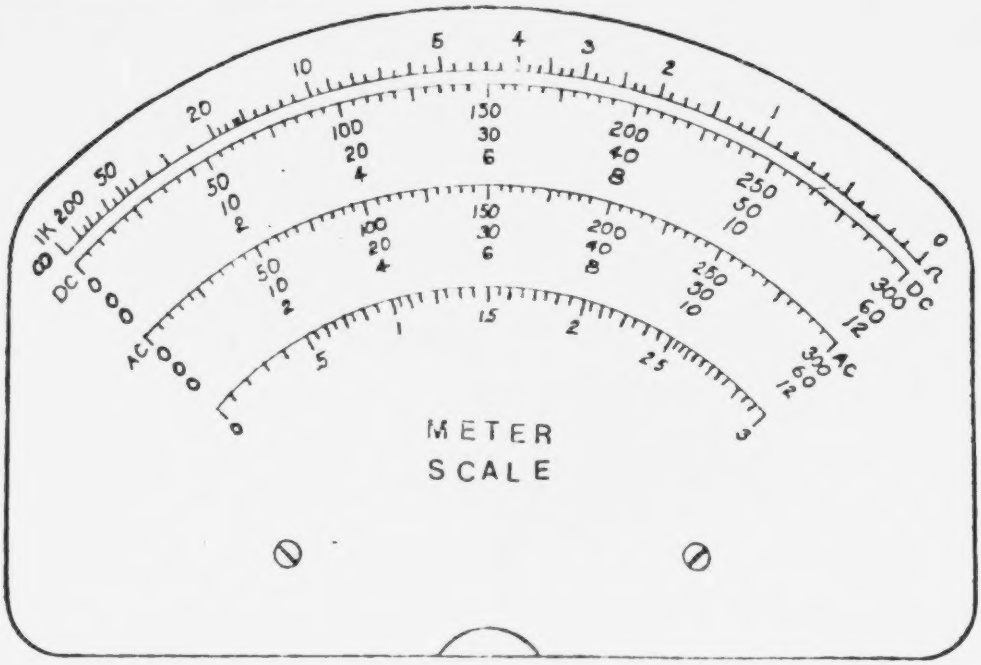
6. Refer now to the diagram of the meter controls shown above. Put the red test lead in the hold or "jack" marked with the letter A and the black test lead in the hold or jack labeled with the letter B. (NOTE: The meter you are using may be different from the one shown. If so, plug the red and black test leads into the proper jacks and proceed.)

7. Touch the test leads together.

8. You have now adjusted the function selection switch to the ohms function of the VOM, put the test leads into the proper jacks, and touched the leads together (shorted). The meter needle moves form the left side of the meter scale to the right side.

9. You will now learn about the meter's scale. Shown below is the scale of a common type of VOM.

Instruction Sheet II (page 3)



10. Notice that the top scale, from 0 to INFINITE (oo) is labeled OHMS. This scale is used for measuring ohms, only. On most VOM's, the top scale is the resistance or ohms scale. Note the location and color of the ohms scale used on your meter.

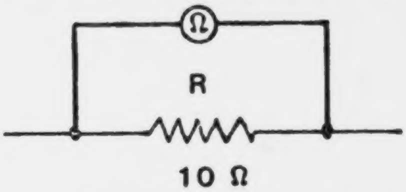
11. To measure any resistance, you msut select the proper meter range. On the meter range shown, there are four ranges: X1, X10, X1,000, and X100,000.

12. The ohmmeter must be properly "zeroed" before attempting to measure resistance. To properly "zero" the ohmmeter, touch the two test leads together. This should cause the needle to move from infinite (oo) on the left to zero (0) on the right. Infinite represents a very high resistance, while zero represents a very low resistance. If the needle does not reach zero or if it goes past zero when the test leads are touched or shorted, then the control marked "Ohms Adjust" must be used to adjust the needle to zero when the test leads are touched together. The ohms adjust control is indicated with the letter "C" on the diagram. There will be a similar adjustment on your VOM if your's is different from the one shown.

13. Adjust the VOM to each of its ranges: X1, X10, X1,000, and X100,000; and "zero" the meter for each of these ranges. THE OHMETER SHOULD BE ZERO PRIOR TO EACH RESISTANCE MEASUREMENT AND AFTER EACH RANGE CHAN otherwise, your measurements will be incorrect.

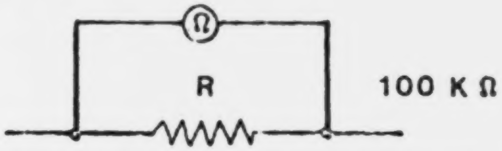
Instruction Sheet II (page 4)

14. A more accurate measurement of resistance can be made when the meter's needle stops somewhere between the center of the ohms scale and the zero. Choosing the proper range adjustment will control how far the needle moves. Adjust the function selection switch to the X1 range. Zero the meter and then connect it to a 10 ohm resistor as shown below Record the actual resistance in ohms shown on the ohms scale.



15. The range selected for this operation was X1. This means that the number to which the needle points will be multiplied by 1.

16. Adjust the function selection switch to the 100K range. Zero the meter and connect it to a 100,000 ohm resistor as shown below. Record the resistance in ohms shown on the ohms scale.



17. The range selected for this measurement was X100,000. This means that the number to which the needle points will be multiplied by 100,000.

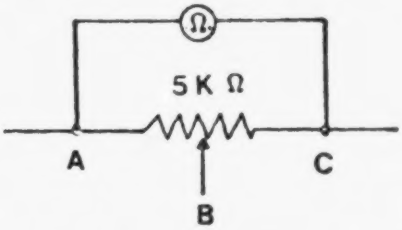
18. Measure and record the values of the resistors listed in the chart below. If you need to review resistor color coding, go to Instruction Sheet I at this time.

Color Coded Value in Ohms	Measured Value in Ohms
10	
33	
220	
470	
1K	
5.6K	
100K	
500K	
1MEG	

Instruction Sheet II (page 5)

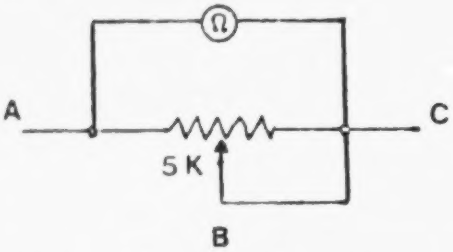
19. Be sure you choose a meter range that will cause the needle to move to somewhere between the center of the scale and zero. Always zero the meter when changing ranges, and always multiply the number indicated on the scale by the multiplier of the range: X1, X10, X100, X1,000, or X100,000. (NOTE: NEVER MEASURE THE RESISTANCE OF A COMPONENT UNTIL IT HAS BEEN DISCONNECTED OR YOUR READING MAY BE WRONG.)

20. Practice the proper procedure for measuring resistance. Measure and record the value of a 5K ohm potentiometer as shown below.



21. Adjust the control of the POT shown in Step #20 while the ohmmeter is connected to points A and C. Notice that this adjustment does not affect the measured resistance of the potentiometer.

22. Adjust the connections of the potentiometer as shown below by connecting together points B and C.



23. Adjust the potentiometer shaft both clockwise and counter clockwise. Note that this adjustment affects the measured resistance. The resistance should vary from zero to maximum and from maximum back to zero.

24. Practice proper usage of equipment. After practice, remember to return all materials to their proper storage area.

INSTRUCTOR'S FINAL CHECKLIST

MEASURE RESISTANCE

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

While measuring resistance with a meter the student:

	FULLY AC	NOT AC	NOT AP
1. Selected the proper tools.	____	____	____
2 Selected the proper meter "function" settings.	____	____	____
3. Selected the proper meter "range" settings.	____	____	____
4. Read the scale of the meter accurately.	____	____	____
5. Used the proper meter range multiplier for determining resistance accurately.	____	____	____
6. Place the meter probes into the correct terminals for measuring resistance.	____	____	____
7. Connected the meter to the component being measured properly.	____	____	____
8. Adjusted the meter needle to the zero mark on the scale when over the meter range setting was changed.	____	____	____
9. Performed all tasks in a safe manner.	____	____	____

Appliance Repairer

MEASURE VOLTAGE

INTRODUCTION

Voltage is applied to electrical equipment to cause the equipment to operate. It is important to be able to measure voltage to check the operation of equipment. Many electrical problems develop due to either too much or too little voltage being applied to the equipment. In this task assignment you will learn to use a meter to measure voltage in an electrical circuit.

OBJECTIVE

Given selected electrical circuits and a VOM, measure the voltages in the circuits. Readings must agree with those of the instructor. Your performance will be rated according to the instructor's final checklist.

CHECK-OUT ACTIVITY

Your instructor will provide you with the necessary materials to construct some simple electrical circuits. Construct the circuits and use a VOM meter to measure the voltage accurately at points designated by the instructor.

Learning Activities

1. READ Whirlpool Corporation, Basic Electricity for Appliances, pages 24-25, and 89-90.
2. OBSERVE your instructor demonstrate using a VOM to measure voltage in electrical circuits.
3. CHECK YOUR KNOWLEGE by completing Student Self-Check I.
4. READ Instruction Sheet I, "Measuring Voltage."
5. PRACTICE the techniques for measuring voltage by following the steps outlined in Instruction Sheet I.
6. COMPLETE the check-out activities listed for this task assignment. You will be rated according to the instructor's final checklist.

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Student Self-Check I

MEASURING VOLTAGE

Answer the following question. Then check your answers with those at the bottom of the page.

1. What is voltage?

2. If you were measuring an unknown voltage, what meter range would you use? Why?

3. What determines how the polarity of the meter matches the polarity of the voltage drop across a resistor?

4. When is it necessary to multiply or divide a scale reading on a VOM?

5. How is the proper voltage range of the VOM selected?

6. Could four volts be measured on the 3-volt range of a VOM? Why?

7. What are the proper ranges on the meter that you are using for mesuring the following voltages? 10V, 2.8V, 6V, 100V, 65V and 40V?

Answers:

1. Electrical pressure which causes current to flow in a circuit.
2. Use the highest voltage range, so the meter will not be damaged by a higher voltage than a lower range can measure.
3. Since current flows from negative side of the battery and the positive lead is connected nearest to the positive side of the battery.
4. When the range that the meter is set on is not the same as any of the numbers on the right side of the meter scale.
5. If you know what the voltage should be, start at a range which is a higher value; then if the voltage is less than the value of the next smaller range, switch to that range; the final reading should be made on the right side of the meter scale.
6. No, the meter needle would move too far to the right and probably damage the meter.
7. On the meter of Instruction Sheet I:
   10V = 12 range
   2.8V = 3 range
   6V = 12 range
   100V = 300 range
   65v = 300 range
   40V = 60 range

Instruction Sheet I

MEASURING VOLTAGE

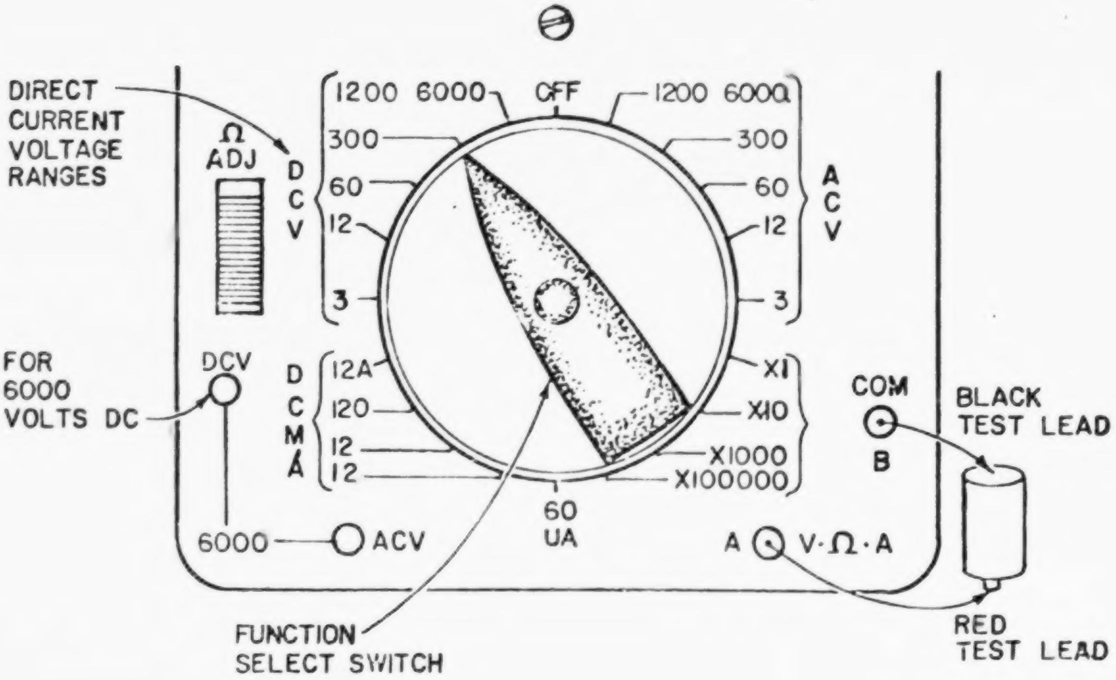
EQUIPMENT:

(1) Volt-Ohm-Milliammeter (VOM)
(2) Potentiometer (5K ohm)
(3) Resistors (220, 470, 1K ohms)
(4) Battery (6 volt)
(5) Lamp (6 volt, with socket)
(6) Connecting wires

PROCEDURE:

1. Obtain a VOM.

2. You learned in Module APR-6, "Measuring Resistance", that the VOM could be used to measure resistance. The VOM can also be used to measure voltage. Shown below are the controls of a common VOM.


DIRECT CURRENT VOLTAGE RANGES
Ω ADJ
DCV
1200
6000
300
60
12
3
OFF
ACV
1200
6000Ω
300
60
12
3
DCMA
12A
120
12
12
X1
X10
X1000
X100000
60 UA
FOR 6000 VOLTS DC
DCV
6000
ACV
COM
B
A
V·Ω·A
BLACK TEST LEAD
RED TEST LEAD
FUNCTION SELECT SWITCH

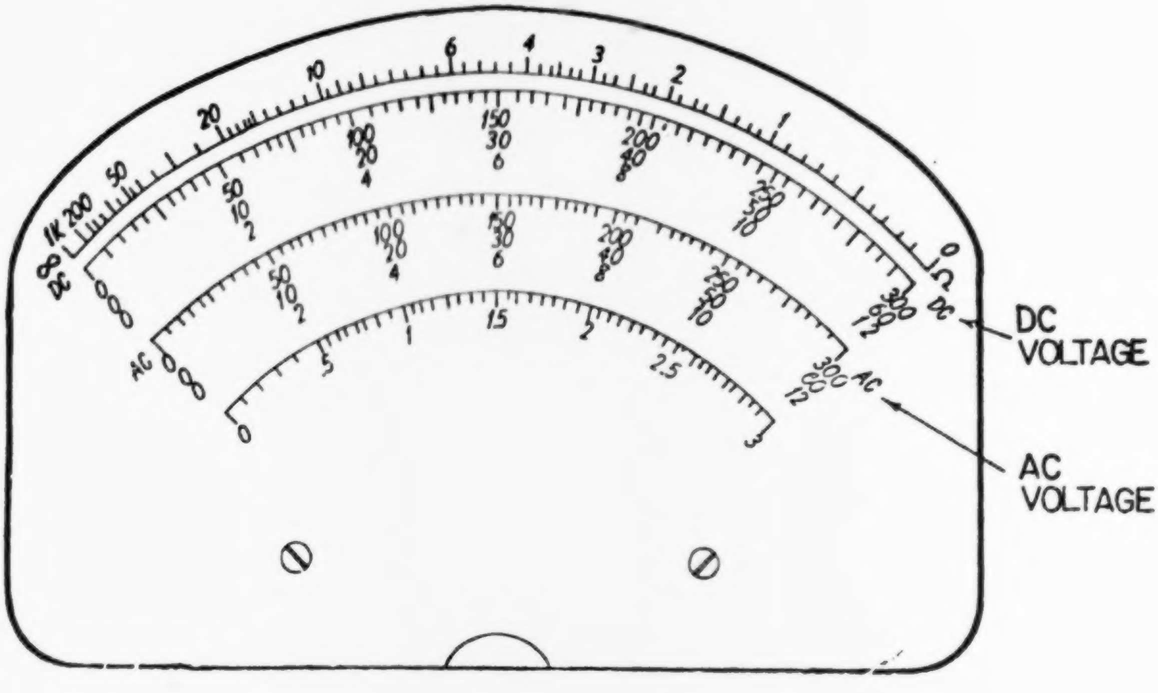
Instruction Sheet I (page 2)

3. You will recall from Module APR-6 that the function selection switch can be adjusted to measurement functions for resistance, voltage and current. The voltage ranges shown on the preceding page are 3V, 12V, 60V, 3000V, 1200V, and 600V. When the function selection switch is adjusted to 3V on the DC volts range, the meter can measure a maximum of 3 volts. The same is true for other ranges of DC voltage. The voltage value of each range is the maximum value of voltage that may be measured with the VOM set on that range. The meter you are using may differ somewhat from the VOM shown in Procedure #2. However, yours will be similar to the one described.

4. Adjust the "function select" switch on your meter to the lowest range of DC voltage. (Note the different ranges of DC voltage on your meter).

5. Connect the red and black test leads to the meter by putting them into the proper jacks. The red test lead should be put into the jack labeled "A" (V- -A) on the diagram. The black test lead should be put into the jacked labeled "B" (-COM). (NOTE: The meter you are using may be different from the one shown. If so, plug the red and black test leads into the proper jacks and proceed.)

6. The VOM is now ready to measure DC voltage. You should now become familiar with the part of the meter's scale that is used to measure DC voltage. Shown below is the scale of a very commonly used VOM.



Instruction Sheet I (page 3)

7. Notice that the part of the scale below the ohms scale is the DC voltage scale. This scale is usually black. Notice that there are four DC voltage scales: 0 to 3V, 0 to 12V, 0 to 12V, 0 to 60V, 0 to 1200V, and 0 to 6000V. All DC voltages are measured using one of these scales. Notice that each of the DC voltage range on the function select switch corresponds to a number on the right side of the meter scale or a number that can be easily multiplied or divided to equal the number on the function switch. The chart below shows the proper scale to read each range of DC voltage.

DC VOLTAGE RANGE SETTING	METER SCALE TO USE	NUMBER TO MULTIPLY BY	NUMBER TO DIVIDE BY
3V	0 to 300		100
12V	0 to 12	none (Read Directly)	none (Read Directly)
60V	0 to 60	none	none
300V	0 to 300	none	none
1200V	0 to 12	100	
*6000V	0 to 60	100	

* On this meter, the red test lead must be put into the jack marked 6000 DCV.

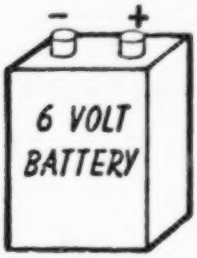
8. Notice tht when the 12V, 60V, or 300V range is used, you must read the scale directly. On these ranges, the number to which the needle points is the actual value of the voltage being measured. When you used the 3V, 1200V, or 6,000V range, the number to which the needle points must be multiplied or divided by 100. If the meter's needle points to the number 50 while the meter is adjusted to the 60V range, the measured voltage is 50V. If the meter's needle points to the number 250 while the meter is adjusted to the 3V range, the measured voltage is 2.5V (250 ÷ 100 = 2.5). When the 1200V range is used, the numbers on the 0 to 12 volt scale are read and multiplied by 100. (NOTE: The meter you are using may differ slightly from the one described above. Generally, the VOM you are using will have several scales. Some of these scales can be read directly while others will require mutliplication or division. If your VOM is different, identify the scales that can be read directly and the ones that must be multiplied or divided.)

Instruction Sheet I (page 4)

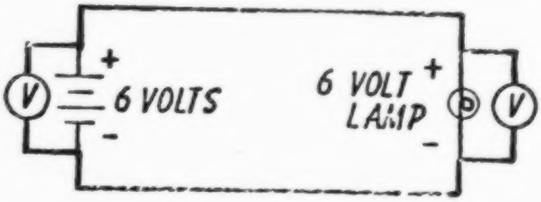
9. You should now know how to use the meter scale and range switch to measure DC voltage. Before making any measurements, you should learn to choose the proper DC voltage range. You will recall from Procedure #2 that the value of the range you are using is the maximum value of voltage that may be measured on that range. For example, when the range selected is 12V, the maximum voltage that the meter can measure is 12 volts. Any voltage above 12V would damage the meter while on this scale. If you are going to measure a voltage that is unknown (no indication as to its approximate value), you should start the measuring procedure by using the highest range on your scale. Then, slowly adjust the range downward until a voltage reading is indicated on the right side of the meter scale.

10. You should also learn about meter polarity. Matching of meter polarity to the voltage polarity is very important when measuring DC voltage. The meter needle will move backwards, possibly causing damage to the meter, if polarities are not connected properly. Meter polarity is simple to determine. The positive (+) red test lead is connected to the positive side of the DC voltage being measured. The negative (-) black test lead is connected to the negative side of the DC voltage being measured.

11. Obtain a 6-volt battery. Measure, and, on a separate piece of paper, record the actual voltage of this 6-volt battery. The voltmeter is always connected across (in parallel with) the voltage being measured.



12. You should now construct the circuit shown below. Measure, and on a separate piece of paper, record the voltage of the battery and the voltage across the lamp.



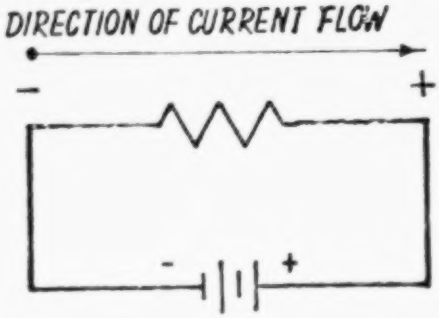
BATTERY VOLTAGE = ______________

LAMP VOLTAGE = ______________

Instruction Sheet I (page 5)

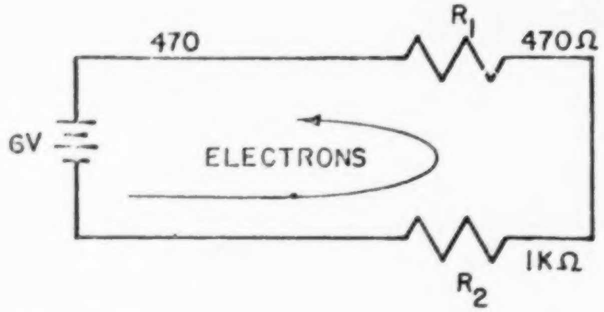
13. A certain amount of voltage is always necessary to cause electrical current to flow through a resistance. This voltage is called voltage drop. It is measured across any component through which current flows. The polarity of the voltage drop depends upon the direction of current flow from negative to positive.

14. If current is flowing through a resistor in the direction shown below,



the left side of the resistor would be negative (-) and the right side would be positive (+). The black test lead of the meter would be connected to the right side. This would allow you to properly measure the voltage drop across the resistor.

15. Construct the following circuit. Measure, and, on a separate piece of paper, record the battery voltage and the voltage drops across R_1 and R_2. Remember, current flows from negative to positive.

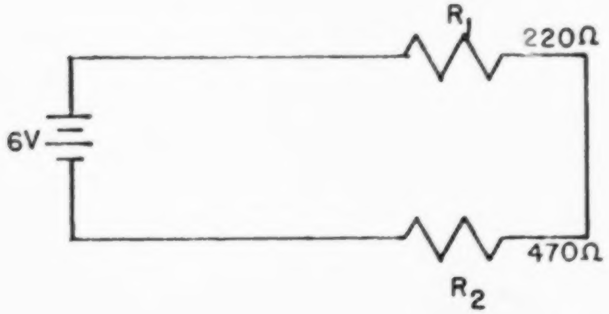


BATTERY V=______VDC

R_1V = ____________ VDC

R_2V = ____________ VDC

16. Construct the following circuit. Measure, and on a separate piece of paper, record the voltage drops across R_1 and R_2.

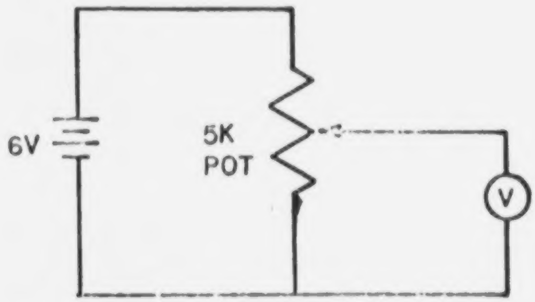


VOLTAGE DROP R_1 = ______VDC

VOLTAGE DROP R_2 = ______VDC

Instruction Sheet I (page 6)

17. Construct the circuit shown below.



18. Adjust the potentiometer shaft fully counter-clockwise and then fully clockwise. Record the voltage across the potentiometer.

Counter-clockwise voltage = __________ VDC
Clockwise voltage = __________ VDC

19. Return all materials to their proper storage area.

INSTRUCTOR'S FINAL CHECKLIST

MEASURE VOLTAGE

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

While measuring voltage with a meter, the student:

	FULLY AC	NOT AC	NOT AP
1. Selected the proper materials.			
2. Constructed the circuits properly.			
3. Selected the proper meter "function" settings.			
4. Selected the proper meter "range" settings.			
5. Read the scale of the meter accurately.			
6. Observed proper meter polarity when making measurements.			
7. Connected the meter in the circuit properly.			
8. Performed all tasks in a safe manner.			

Appliance Repairer

MEASURE CURRENT

INTRODUCTION

Current flows through a complete electrical circuit when voltage is applied. Many important tests can be made by measuring the current flow in an electrical circuit. The current values in an electrical circuit depend upon the amount of resistance in the circuit. In this task assignment, you will learn to use a meter to measure current in an electrical circuit.

OBJECTIVE

Given various simple electrical circuits and an ammeter, measure current in the **circuits. Readings must agree** with those of the instructor. You will be **rated according to the** instructor's final checklist.

CHECK-OUT ACTIVITY

Your instructor will provide you with the necessary materials to construct simple electrical circuits. Construct the circuits and use a meter to measure current in the circuits accurately. You will be rated according to the instructor's final checklist.

Learning Activities

1. READ Whirlpool Corporation, Basic Electricity for Appliances, page 25.

   (or) ____________________

2. OBSERVE your instructor demonstrate the techniques of measuring current in an electrical circuit.
3. CHECK YOUR KNOWLEDGE by completing Student Self-Check I, "Measuring Current."
4. READ Instruction Sheet I, "Measuring Current."
5. PRACTICE measuring current on a unit provided by the instructor.
6. COMPLETE the check-out activity listed for this task assignment. You will be rated according to the instructor's final checklist.

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Student Self-Check I

MEASURING CURRENT

On a separate piece of paper, answer the following questions. Check your answers with those on the next page.

1. What is current?

2. How is the VOM properly connected into a circuit to measure current flow?

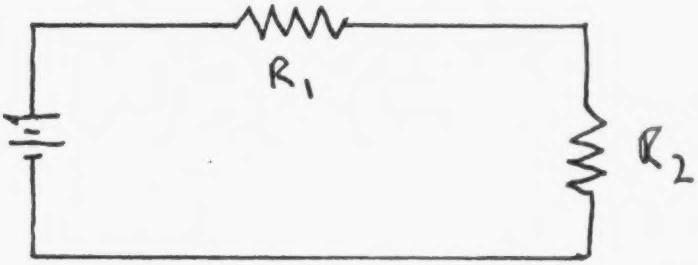
3. Why is proper polarity important when measuring direct current?

4. What meter ranges would be selected to measure the following current?

Current	Range
.009 Amps	
.11 Amps	
.8 Amps	

5. What is the proper procedure to be followed when attempting to measure an unknown current?

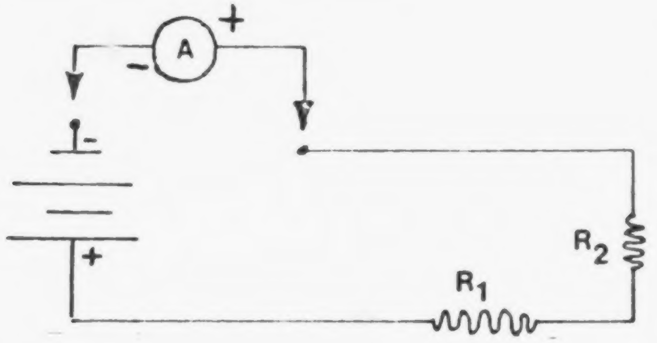
6. How would a current meter be connected in the circut below to measure the current flow? Redraw the circuit and be sure to show the proper meter polarity?



Student Self-Check I Answers

1. The flow of tiny charged particles from the negative polarity of a voltage source to the positive polarity.

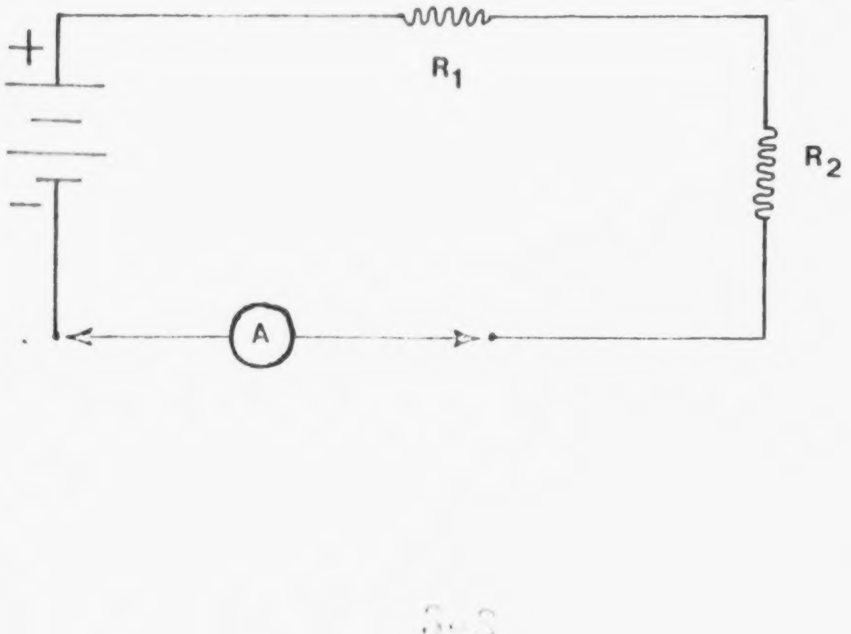
2. A wire is removed from the negative polarity of the voltage sources and the negative test lead of the meter is connected to the negative polarity of the voltage source; the positive test lead is then connected to the wire which was removed. (See below)



3. If polarity is reversed, the meter needle will move in the wrong direction and possibly damage the meter.

4. .009 Amps = 9 Milliamps -- 12 MA range
.11 Amps = 110 Milliamps -- use 120 MA range
.8 Amps = 800 Milliamps -- use 12 Amp range

5. Start with the highest current range; watch the movement of the meter needle as it moves to between the center and right side of the meter scale.



Instruction Sheet I

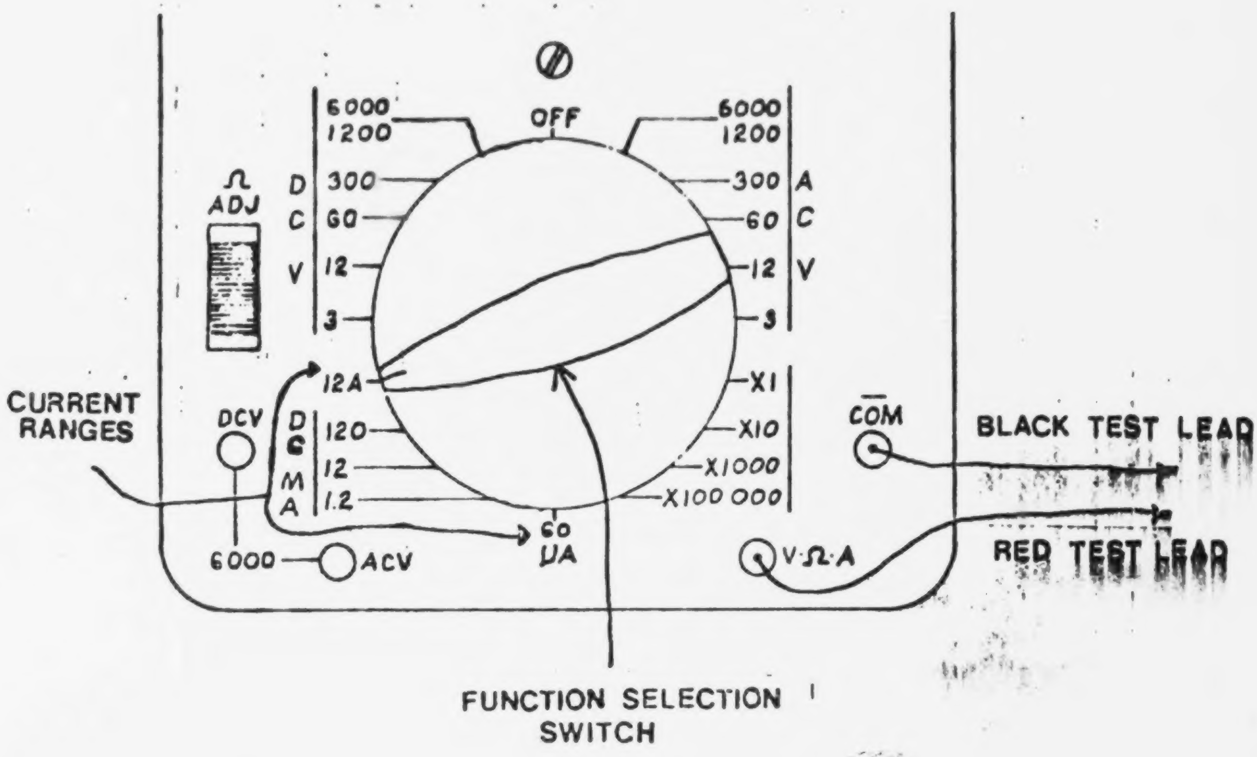
MEASURING CURRENT

MATERIALS:

(1) Volt-Ohm-Milliameter (VOM)
(2) Resistors (220, 1K, 100K, 500K ohms)
(3) Battery - 6 volt
(4) Switch - SPST
(5) Connecting wires

INFORMATION:

A. You learned in previous task assignments that a VOM can be used to measure resistance and voltage. The VOM can also be used to measure current. Shown below are the controls of a common VOM.


OFF
6000
1200
D C V
300
60
12
3
6000
1200
A C V
300
60
12
3
Ω ADJ
12A
CURRENT RANGES
DCV
D C M A
120
12
1.2
X1
X10
X1000
X100 000
60 μA
COM
BLACK TEST LEAD
6000
ACV
V·Ω·A
RED TEST LEAD
FUNCTION SELECTION SWITCH

Instruction Sheet I (page 2)

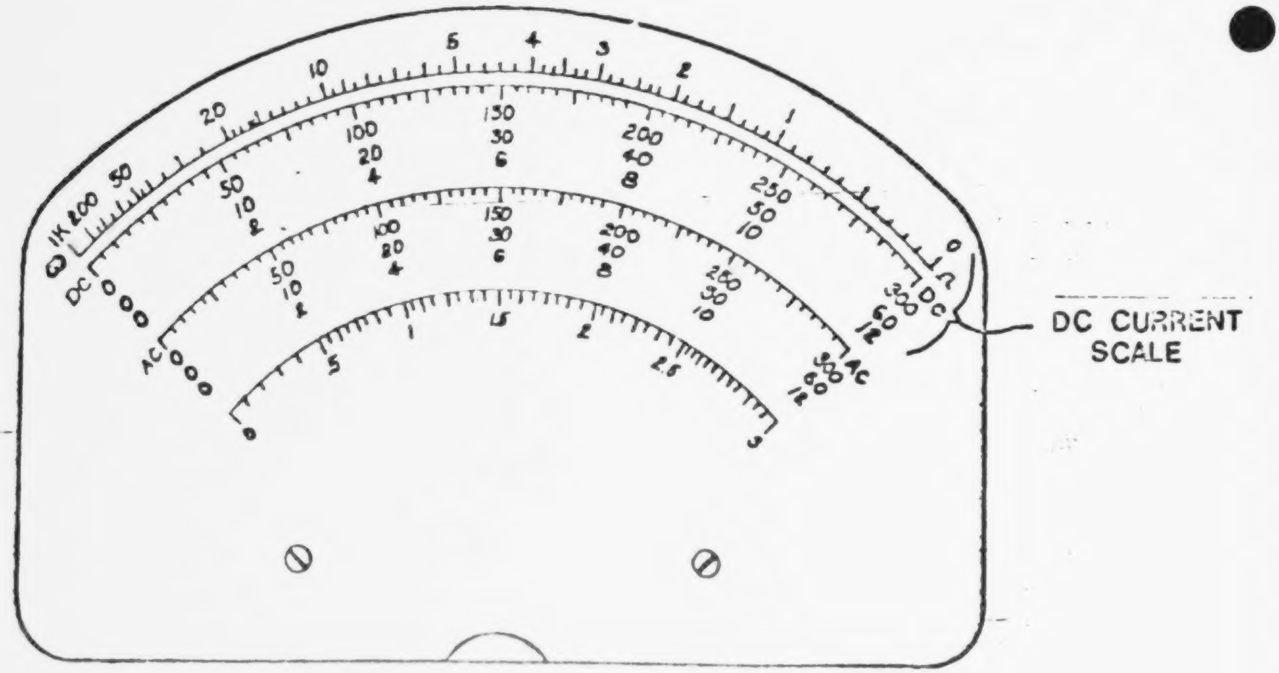
B. The function select switch controls the range of measurements to be made with the VOM. The diagram on the preceding page shows that the function selection switch may be adjusted to any of five ranges of Direct Current. These are: 12 amps, 120 milliamp, 12 milliamp, 1.2 milliamp, and 60 microamp. For example, when the function select switch is placed in the 120 MA position in the direct current ranges, the meter is capable of measuring a maximum of 120 milliamps. The value of the current being used is the maximum value of current which may be measured with the VOM adjusted to that range.

PROCEDURE:

1. Obtain a VOM. NOTE: The meter you are using may differ somewhat from the VOM shown in the illustration. However, it should be basically the same.

2. Adjust the function select switch on your meter to the highest range of direct current. Record the different ranges for measuring direct current on your meter.

3. Plug the black and red test leads into the holes as shown in the diagram. (NOTE: If your meter is different from the one shown, plug the test leads into the proper holes and proceed.) You are now ready to measure direct current. Shown below is a scale of a very common VOM.


Ω
1K
200
50
20
10
5
4
3
2
1
0
Ω
DC
0
50
10
2
100
20
4
150
30
6
200
40
8
250
50
10
300
60
12
DC
AC
0
50
10
2
100
20
4
150
30
6
200
40
8
250
50
10
300
60
12
AC
0
.5
1
1.5
2
2.5
3
DC CURRENT SCALE

Instruction Sheet I (page 3)

Notice that the same scales are used for measuring direct current as was used for DC voltage. There are several direct current ranges which can be used, but all current measurements are read on these scales. The chart below shows the proper number to multiply or divide by when using the direct current scale for any of the five ranges.

Direct Current Range	Multiply	Divide
60 MA (microamp)	None	_____
1.2 MA (milliamp)	_____	10
12 MA (milliamp)	None	_____
120 MA (milliamp)	10	_____
12 A (amps)	None	_____

(NOTE: Your meter may have different scales than those shown above. If so, make the necessary changes in the chart.)

4. If the meter's needle pointed to the number 6 on the direct current scale while the meter was adjusted to the 12 MA range, the measured current would equal 6 MA. If the needle pointed to 6 while the meter was adjusted to the 120 MA range, the measured current would equal 60 MA (6 X 10 = 60).

5. On a separate sheet of paper, prepare and complete a chart similar to the one on the following page by determining the proper current value when the meter needle points to the number listed. Also, list the current number to multiple or divide by on that current range. If your meter is different, you should use similar values for each column.

   CAUTION: Remember that the value of the range setting is the maximum value of current that may be measured on that range. For example, when the range is set to 12 MA, the meter is capable of measuring a maximum of 12 MA. Any current above 12 MA would damage the meter when adjusted to this range.

   If you are trying to measure an unknown current, you should start the measuring procedure by using the highest range on your meter and slowly adjust the range downward until a current reading is indicated on the meter scale.

Instruction Sheet I (page 4)

Meter Range	Number Needle Points to	Current Value	Multiply	Divide
Example:				
12 MA	8	8 MA	none	none
120 MA	2			
120 MA	7			
1.2MA	4			
12 MA	9			
60 A	50			
120 MA	7.50			
1.2 MA	3.20			
60 MA	6			
12 A	8.50			

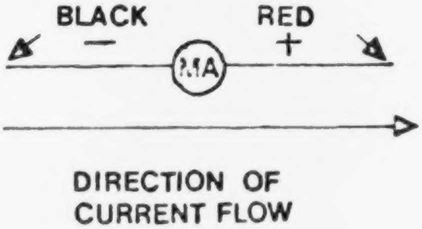
6. Prepare and complete, on a separate sheet of paper, a chart similar to the following chart by listing the proper meter range to be used and the proper number to multiply or divide by on the scale reading for each value of current to be measured. (NOTE: Always select the smallest range that will allow you to measure the current.)

Instruction Sheet I (page 5)

Current to be Measured	Range to Select	Multiply	Divide
Example: .9 MA	1.2 MA	___	10
2 amps			
900 MA			
25 A			
2 MA			
85 MA			
6 MA			
.5 MA			
16 MA			
9 MA			
Unknown current			

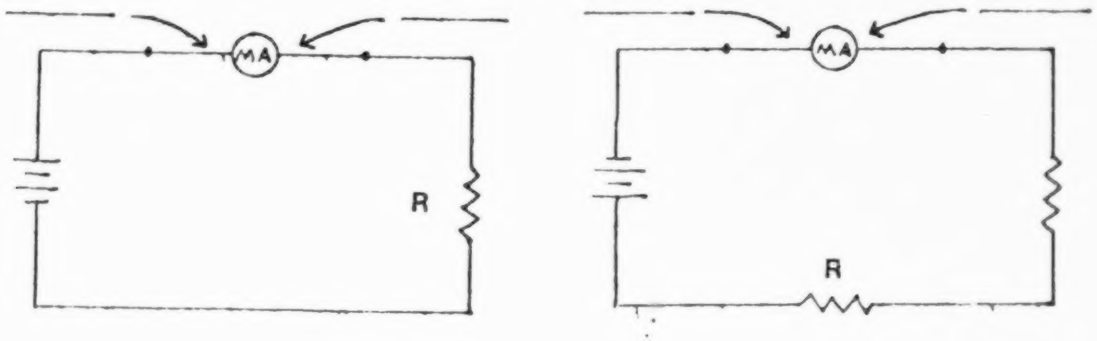
7. The test lead polarity of the VOM is important when measuring direct current. The VOM must always be connected to allow the current to flow through the meter in the proper direction, otherwise the meter needle will move backwards. This could cause damage to the meter. If current is to flow through the meter in the proper direction, consideration must be given to the direction of current flow.

8. You will recall from other activities that current flows from negative to positive. If the meter is connected correctly into a circuit, current will flow through. (The black test lead (-) through the meter and then through the red test lead (+).) The diagram below should help you remember how current flows through the meter.

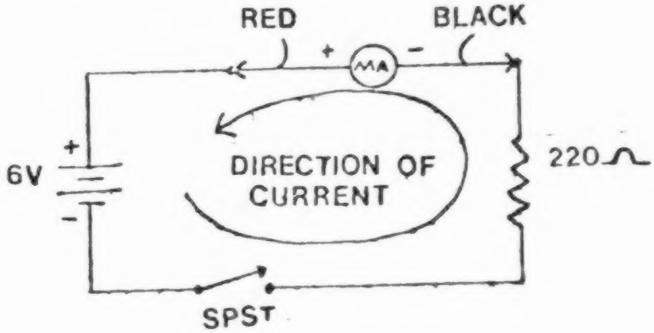


Instruction Sheet I (page 6)

9. In the diagram below, show which test lead should be red (+) and which should be black (-) for the current meters in the circuits.

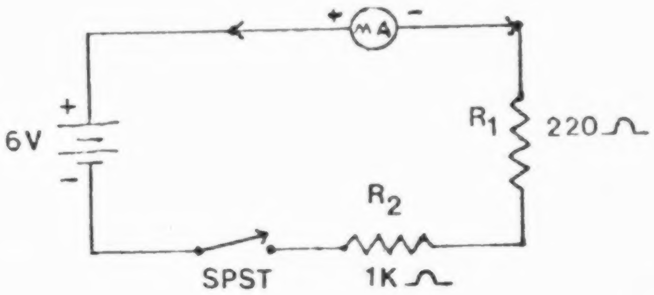


10. Adjust the VOM to the 120 MA direct current range. Connect it into the circuit as shown below. Be sure to use the proper meter polarity.


RED
BLACK
+
MA
-
+
6V
-
DIRECTION OF CURRENT
220Ω
SPST

11. Close the SPST switch and record the current reading on the VOM.

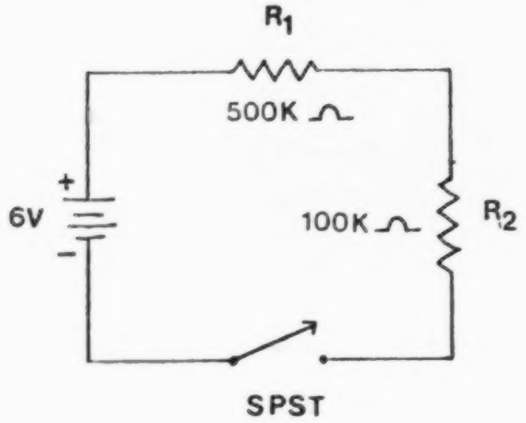
12. Open the SPST switch and add the other resistor as shown below.


+
MA
-
+
6V
-
R1
220Ω
R2
SPST
1KΩ

13. Change the range of the VOM to 12 MA. Close the switch. Record the current reading on the VOM.

Instruction Sheet I (page 7)

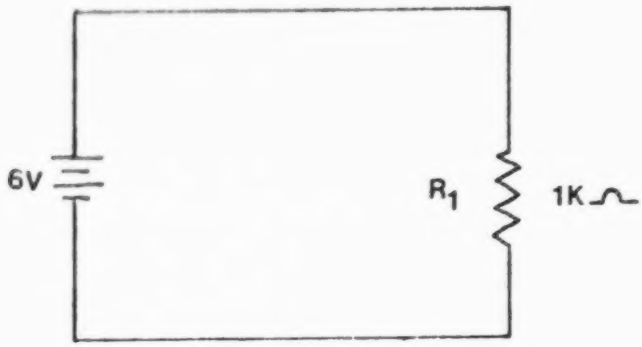
14. Disconnect the circuit pictured in proceure #12. Connect the circuits shown below.



15. Adjust the VOM to the 60 MA range. Connect the meter into the circuit. Be sure to use proper polarity. Close the switch and record the current.

16. Disconnect this circuit.

17. Construct the circuits shown below.



18. Adjust the VOM to the 12 MA range. Connect it into the above circuit. Be sure to use proper polarity. Record the current flow.

19. Return all materials to their proper storage area.

INSTRUCTOR'S FINAL CHECKLIST

MEASURE CURRENT

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

While learning to measure current with a meter, the student:

	FULLY AC	NOT AC	NOT AP
1. Selected the proper materials.			
2. Constructed the circuits properly.			
3. Selected the proper meter "function" settings.			
4. Selected the proper meter "range" settings.			
5. Read the scale of the meter accurately.			
6. Observe proper meter polarity when making measurements.			

Appliance Repairer

APPLY BASIC ELECTRICAL THEORY

INTRODUCTION

In order to understand electrical testing and servicing better, you should know how to apply basic electrical theory. Electricity is a mathematical subject area. The mathematics is easy to understand, since it has practical applications which are easy to see. The main basic theory is called Ohm's Law. In this task assignment you will learn about Ohm's Law and how to apply basic electrical theory to actual circuits. Before you begin this task assignment complete the task assignment "Measuring Current."

OBJECTIVE

After you have complete this task assignment, you will be able to calculate values for current, resistance, and voltage which will agree with meter readings. You will be rated according to the instructor's final checklist.

CHECK-OUT ACTIVITY

Given various electrical circuits, a VOM, and the necessary formulas, calculate values for current, resistance, and voltage. Calculated values must agree with meter readings.

Learning Activities

1. READ Whirlpool Corporation, Basic Electricity for Appliances, pages 27-28.
2. PRACTICE with the help of your instructor on problems applying basic electrical theory.
3. CHECK YOUR KNOWLEDGE by completing Student Self-Check I, "Applying Basic Electrical Theory."
4. READ Instruction Sheet I, "Applying Basic Electrical Theory."
5. PRACTICE applying basic electrical theory on circuits provided by the instructor.
6. COMPLETE the check-out activities listed for this task assignment. You will be rated according to the instructor's final checklist.

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Student Self-Check I

APPLYING BASIC ELECTRICAL THEORY

On a separate sheet of paper, answer the following questions. Check your

1. How is current affected if voltage is doubled and resistance remains the same?
2. How is current affected if resistance is doubled and voltage remains the same?
3. What voltage (E) would cause 10 MA of current (I) flow through a resistance (R) of (10) Ohms?
4. What resistance would cause a current flow of 1 MA with 10 volts applied?
5. What current would flow if 1 volt is applied to 1 ohm of resistance?
6. Use Ohm's Law to solve the following problems.

   (1) A doorbell requires .2 amps of current in order to ring. The voltage applied to the bell is 120 volts. What is its resistance? R = ______________ Ohms.

   (2) A relay used to control a motor is rated at 25 ohm resistance. What voltage is required to operate the relay if it draws a current of .025 amps? E = _________ volts.

   (3) An automobile battery supplies a current of 7.5 amps to a starter motor with a resistance of 0.84 ohms. Find the voltage delivered by the battery. E = volts.

   (4) What voltage is needed to light a lamp if the current required is 2 amps and the resistance of the lamp is 50 ohms? E = _________ volts.

   (5) If the resistance of a radio receiver circuit is 240 ohms and it draws .6 amps, what voltage is needed? E = _________ volts.

   (6) A television tube takes 0.15 amps. The operating voltage is 120 volts. What is the resistance of the TV circuit? R = ________ Ohms.

   (7) The resistance of the motor windings of an electric vacuum cleaner is 20 ohms. If the voltage is 120 volts, find the current. I = __________ amps.

   (8) The magnet of a loudspeaker carries 0.05 amps when connected to a 50 volt supply. Find its resistance. R = ___________ Ohms.

   (9) How much current is drawn from a 12 volt battery when operating an automobile horn of 8 ohm resistance? I = __________ amps.

Student Self-Check I (page 2)

(10) Find the resistance of an automobile starting motor if it draws 90 amps from the 12-volt battery. R = __________ ohms.

(11) What current is drawn by a 5,000 ohm electric clock when operated from a 120 volt line? I = __________ amps.

(12) Find the current drawn by a 50 ohm toaster from a 120 volt line. I = ________ amps.

Instruction Sheet I

APPLYING BASIC ELECTRICAL THEORY

MATERIALS:

(1) Volt-Ohm-Milliammeter (VOM)
(2) Resistors (10, 100, 1K Ohm)
(3) Variable DC power supply
(4) Connecting wires

INFORMATION:

A. Ohm's Law is the most basic and most used of all electrical theories. Ohm's Law explains the relationship of voltage (the force that causes current to flow), current (the movement of electrons), and resistance (the opposition to current flow).

B. Ohm's Law is stated as follows: An increase in the force which causes current to flow (voltage) will increase the movement of electrons (current) as long as the opposition to the the flow of current (resistance) remains the same.

C. Ohm's Law stated in another way is: An increase in the opposition to the flow of current (resistance) will cause a decrease in the movement of electrons (current) when the force that causes current to flow (voltage) remains the same.

D. The electrical values used with Ohm's Law are usually represented with capital letters. For example, voltage is represented with the letter E, current with the letter I, and resistance with the letter R.

E. The mathematical relationship of the three electrical units is shown in the following formulas. You should remember each of these.

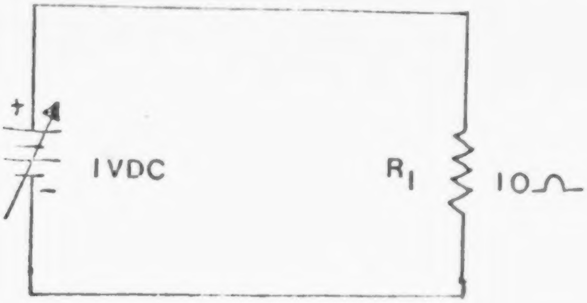
(1) $E = I \times R$
(2) $I = E/R$
(3) $R = E/I$

F. Voltage (E) is always measured in volts. Current (I) is measured in amps. Resistance (R) is measured in Ohms. You can see that if two electrical values are known, the third value can be calculated by using one of the formulas.

Instruction Sheet I (page 2)

PROCEDURE:

1. Construct the circuit shown below. Use a VOM to measure DC voltage as the variable power supply is adjusted.



2. Using the Ohm's Law current formula, I = E/R, the calculated value of I in the above circuit is:

   I = E/R = 1VC/10 ohm = .1 Amps

   Calculated I = .1 amps, or 100 MA.

3. Using the calculated value of I to determine the proper meter range, use the VOM to measure the current of the above circuit. Record this value.

4. Double the voltage in the circuit shown in procedure #1. The calculated current using the Ohm's Law current formula, I = E/R, is:

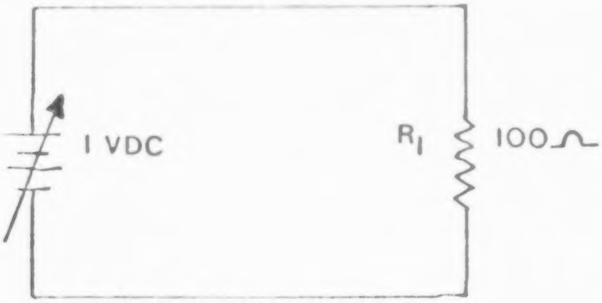
   I = E/R = 2V/10 ohm = .2 Amps

   Calculated I = .2 amps, or 200 MA.

5. Use the VOM to measure the current flow with 2 volts applied to the circuit. Record this value.

   NOTE: You can see from the above procedures that as voltage is increased current will also increase if resistance remains the same. Also, if voltage is doubled, current will be doubled. If voltage is made ten times larger, the current will become ten times larger.

6. Construct the circuit shown below:



Instruction Sheet I (page 3)

7. The calculated current flow in the above circuit is:

   I = E/R = 1V/100 ohm = .01 Amps

   Calculated I = .01 amps, or 10 MA

8. Use the VOM to measure the current in the circuit.

9. Replace the 100 ohm resistor in the circuit in procedure #6 with a 1K ohm resistor. The calculated value of current with 1 volt applied to the 1K Ohm resistor is:

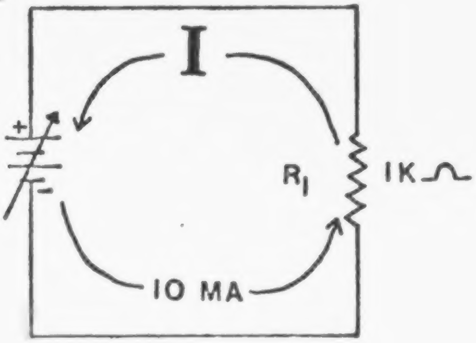
   I = E/R = 1V/1,000 ohm = .001 Amps

   Calculated I = .001 amps, or 1 MA.

10. Measure the new value of current caused by the 1K Ohm resistor.

11. The calculated voltage for the circuit below which would cause .01 amps or 10 MA of current to flow is:

    E = I x R = .01A x 1,000 ohm = 10 Volts



12. Adjust the power supply to the value of voltage calculated in procedure #11. Measure the current caused by this value of voltage.

13. Return all materials to their proper storage area.

INSTRUCTOR'S FINAL CHECKLIST

APPLY BASIC ELECTRICAL THEORY

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

While learning to apply basic electrical theory, the student:

	FULLY AC	NOT AC	NOT AP
1. Selected the proper materials.	____	____	____
2. Constructed the circuits properly.	____	____	____
3. Calculated current according to Ohm's Law.	____	____	____
4. Calculated voltage according to Ohm's Law.	____	____	____
5. Calculated resistance according to Ohm's Law.	____	____	____
6. Used the meter to measure voltage correctly.	____	____	____
7. Used the meter to measure current correctly.	____	____	____
8. Performed all tasks in a safe manner.	____	____	____

Appliance Repairer

WORK WITH ELECTRICAL COMPONENTS, SYMBOLS, AND DIAGRAMS

INTRODUCTION

Most electrical equipment is made of several parts which work together to accomplish some type of operation. It would be almost impossible to explain how electrical equipment operates without using symbols and diagrams to show how the parts of the equipment fit together. In this task assignment, you will first learn to identify some common electrical components. You will then learn how the symbols are used to represent these electrical components. You will also learn how the components of electrical equipment are connected together. These diagrams are used for installing, troubleshooting, and repairing electrical equipment.

OBJECTIVE

Given various simple electrical components, identify and draw their symbols, and construct simple circuits using electrical diagrams and symbols. Identifaction and drawings should agree with those of the instructor. You will be rated according to the instructor's final checklist.

CHECK-OUT ACTIVITY

Your instructor will provide you with several simple electrical components. You will identify the components, draw their symbols, and construct simple circuits using electrical diagrams and symbols.

Kentucky Department of Education
Alice McDonald, Superintendent of Public Instruction
1984-85

Learning Activities

1. READ Whirlpool Corporation, Basic Electricity for Appliances, pages 22-24 and 136-138.

   (or) ______________________________

2. OBSERVE your instructor discuss electrical components, symbols, and diagrams.
3. CHECK YOUR KNOWLEDGE by completing Student Self-Check I.
4. READ Instruction Sheet I.
5. PRACTICE identifying electrical components, drawing their symbols, and constructing circuits using diagrams and symbols.
6. COMPLETE the check-out activities listed for this task assignment. You will be rated according to the instructor's final checklist.

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Student Self-Check I

WORKING WITH ELECTRICAL COMPONENTS, SYMBOLS, AND DIAGRAMS

On a separate piece of paper, answer the following questions.

1. Why are symbols used to represent electrical components?

2. Draw the symbols for the components listed below.

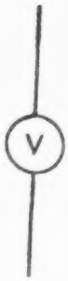
   a. resistor
   b. ground connection
   c. SPST switch

3. Draw the symbols for (a) conductors crossing and (b) conductors connected.

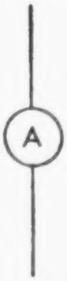
4. Draw the symbol for a battery placing the positive (plus) sign and the negative (minus) sign at the proper sides of the symbol.

5. Identify each of the meter symbols illustrated below.

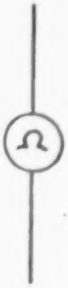
A.



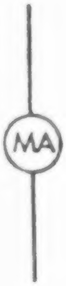
B.



C.



D.



6. Draw a diagram of a circuit which has one battery, two resistors, a single throw switch, and a current meter connected to form one path.

Instruction Sheet I

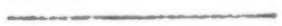
WORKING WITH ELECTRICAL COMPONENTS, SYMBOLS, AND DIAGRAMS

MATERIALS:

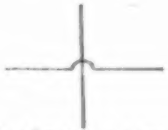
(1) SPST switch
(2) Resistors (3)
(3) Potentiometer
(4) Several connecting wires
(5) 1.5 volt battery
(6) 1.5 volt lamp with socket

INFORMATION AND PROCEDURE:

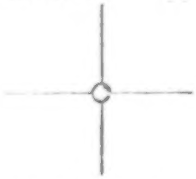
1. The connecting wires you will use in this activity represent paths for current flow. These wires may be connected to each other in several ways. They may also cross each other without being connected. The symbols used to represent these connecting wires, called conductors, are shown below.



a. Conductor

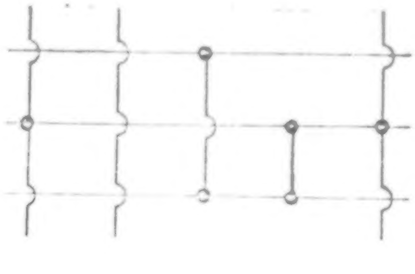


b. Conductors crossing (but not connected)



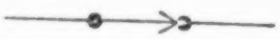
c. Conductors connected

2. In the diagram below, conductors cross each other eight times and conductors are connected to each other six times. Make sure you can recognize them.

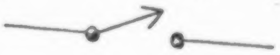


Instruction Sheet I (page 2)

3. A single pole, single throw (SPST) switch is a device used to allow the flow of current when it is "Closed" or "On" and stop current flow when it is "Open" or "Off". This type of switch is similar to the switch used to turn a light in a room "on" or "off". The symbols representing the SPST switch in its two operating conditions, "ON" or "OFF", are shown below.



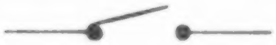
SPST - "On" or "Closed"



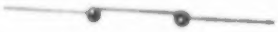
SPST - "Off" or "Open"

4. If you walked into a dark room and wished to turn on the lights, you would close the switch. The switch would be closed to allow current to flow through the switch to the light.

5. Below are the symbols of a switch both when the room is darkened and after the lights are turned on.

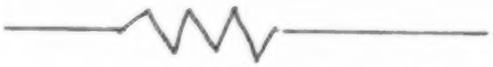


a. Darkened Room

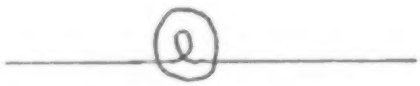


b. Lighted Room

6. Resistors are some of the most widely used devices or components to control the flow of current. The symbol for a resistor is shown below.

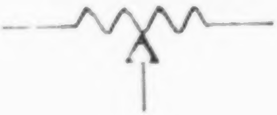


7. The light bulb or lamp is a very common component. It is widely used in flashlights and other devices to produce light. The symbol shown below is that of a lamp or light bulb.

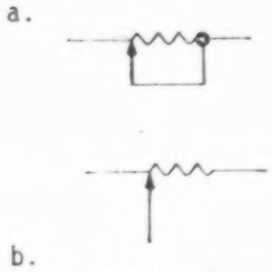


Instruction Sheet I (page 3)

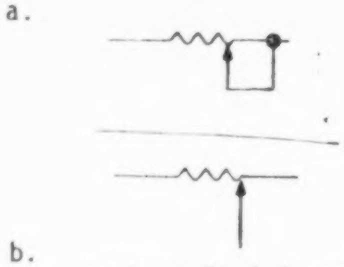
8. The potentiometer or "POT" is a component that can be adjusted to control current flow. The adjustment is similar to that of increasing or decreasing the volume control of a radio or TV set. The graphic symbol for a potentiometer is shown below. Notice that the center connection of the "POT" is shown with an arrow. This represents the moveable part of the device.



9. The symbols below show a potentiometer adjusted to its lowest value of resistance. In the space to the right, the symbols used to represent the potentiometer adjusted to its highest value of resistance are shown.

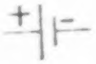


Lowest Resistance

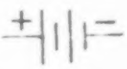


Highest Resistance

10. The 1.5 volt battery is a voltage source that causes current to flow through conductors, resistors, or other components. The symbol below shows a battery. You will notice that one of the connectors of the battery is labeled with a "+" (positive) sign and the other is labeled with a "-" (minus) sign. It is always important to know which side of the battery is connected to the component of a circuit.

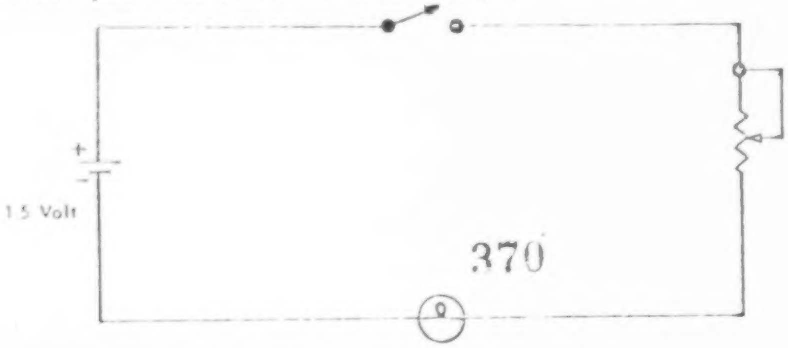


1.5 VOLT BATTERY



BATTERY (OVER 1.5 VOLTS)

11. Arrange the components shown in the circuit below as shown in the diagram. (Check with your instructor if necessary.)



Instruction Sheet I (page 4)

12. Close the SPST switch and adjust the potentiometer shaft from its highest resistance position to its lowest resistance position. The lamp should become brighter as the potentiometer is adjusted.

13. Adjust the potentiometer until the lamp is brightest and open the SPST switch. The lamp should go off since the circuit is now open.

14. Disconnect the circuit and return all materials to their storage area.

INSTRUCTOR'S FINAL CHECKLIST

WORK WITH ELECTRICAL COMPONENTS, SYMBOLS, AND DIAGRAMS

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

The student:	FULLY AC	NOT AC	NOT AP
1. Selected the proper materials.	____	____	____
2. Identified the electrical components properly.	____	____	____
3. Identified the symbols for each component properly.	____	____	____
4. Constructed each circuit properly.	____	____	____
5. Performed all tasks in a safe manner.	____	____	____

Appliance Repairer

CHECK FOR MAGNETISM AND ELECTROMAGNETISM

INTRODUCTION

The operation of motors, generators, transformers, relays, and many other types of electrical equipment depends upon magnetism and electromagnetism. Magnetism is used to cause many electrical devices to operate. An understanding of magnetism and electromagnetism is needed so that you can learn how motors, relays and other electrical equipment operate. In this task assignment you will learn the basic principles of magnetism and electromagnetism.

OBJECTIVE

Your instructor will provide you with a set of bar magnets, a compass, and the necessary materials to construct an electromagnet. Use the bar magnets and the electromagnet you construct to make observations and measurements which show the presence of magnetism and electromagnetism. You will be rated according to the instructor's final checklist.

CHECK-OUT ACTIVITY

Given a set of bar magnets, a compass, and the materials to construct an electromagnet, make observations and measurements which indicate the presence of magnetism and electromagnetism. Your findings must agree with pre-recorded results.

Learning Activities

1. READ Whirlpool Corporation, Basic Electricity for Appliances, pages 39-51.

   (or) ____________________

2. OBSERVE a demonstration by your instructor on the principles of magnetism and electromagnetism.

3. CHECK YOUR KNOWLEDGE by completing Student Self-Check I, "Understanding Magnetism and Electromagnetism."

4. READ Instruction Sheet I, "Checking for Magnetism and Electromagnetism."

5. PRACTICE checking for magnetism and electromagnetism on an appliance provided by your instructor.

6. COMPLETE the check-out activity listed for this task assignment. Your performance will be rated according to the Instructor's Final Checklist.

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Student Self-Check I

CHECKING FOR MAGNETISM AND ELECTROMAGNETISM

On a separate sheet of paper, answer each of the questions below.

1. What is the relationship between like poles and unlike poles of magnets?
2. How can a piece of soft iron be magnetized?
3. What is meant by magnetic flux?
4. In what direction does magnetic flux travel around the outside of a magnet?
5. Make a sketch of the magnetic flux around a permanent magnet?
6. What is an electromagnet?
7. What are three factors that affect the strength of an electromagnet?

Instruction Sheet I

CHECKING FOR MAGNETISM AND ELECTROMAGNETISM

MATERIALS:

(1) Permanent Magnets (2)
(2) Compass
(3) Soft Iron Core - 3/4" diameter, 6" long
(4) Wire - 20" length of #12
(5) Variable DC Power Supply
(6) Volt-Ohm-Milliammeter (VOM)
(7) Wound Coil - 2" diameter, #18 wire, open center

PROCEDURE:

1. Place a permanent magnet on the work area in front of you.

2. Obtain a compass.

3. Look at the needle of the compass. You will see that the north pole of the compass needle (the one that points north) is colored or marked so that you can tell the difference between it and the south pole.

4. Use the compass to find the north and south poles of the permanent magnet. Mark the north and south poles of your permanent magnet, if they are not already marked.

5. Use the same procedure to mark the north and south poles of the other permanent magnet.

6. When you bring the north pole of one magnet near the north pole of the other magnet, you will see that they repel each other.

7. When you bring the south pole of one magnet near the south pole of the other magnet, you will see that they also repel each other.

8. When you bring the north pole of one magnet near the south pole of the other magnet, you will see that they attract each other.

9. Remove the magnets from the work surface.

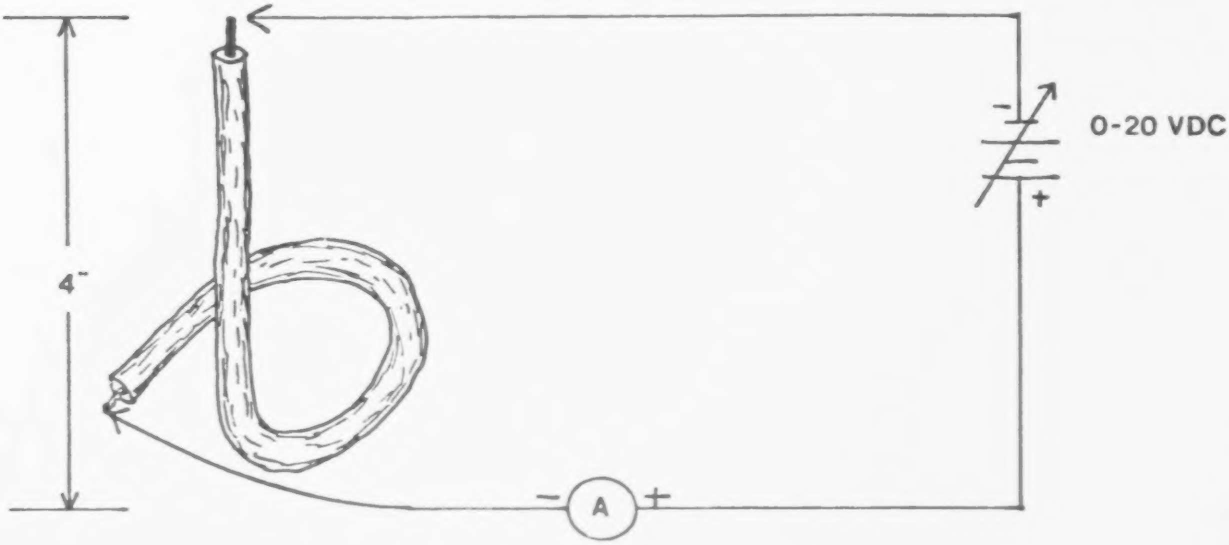
10. Place the soft iron core on the work area. Move the compass very near the soft iron. Now you can see that the compass needle is not attracted to the soft iron core.

Instruction Sheet I (pge 2)

11. Place the soft iron core and a permanent magnet together. Gently stroke the iron core with the magnet for a period of two minutes. (The stroking action must be in the same direction.)

12. Remove the permanent magnet from the work area. Place the compass near the iron core. The needle of the compass should now be attracted to the soft iron core. The core has now become magnetized.

13. Prepare a 20-inch length of #12 wire as indicated below. It should stand up when the loop end is placed on a flat surface. Remove 1/2 inch of insulation from each end of the wire.



14. Prepare a meter to measure up to 3 amps of direct current. Connect the DC power supply and meter as shown in the diagram.

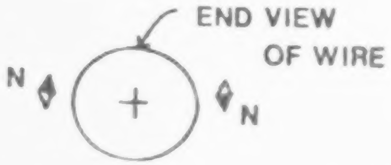
15. Adjust the variable DC power supply to "0" volts. Then turn on the power supply. Carefully adjust the power supply to produce 3 amps as measured on the meter.

16. Disconnect the negative test lead of the meter which connects to the wire.

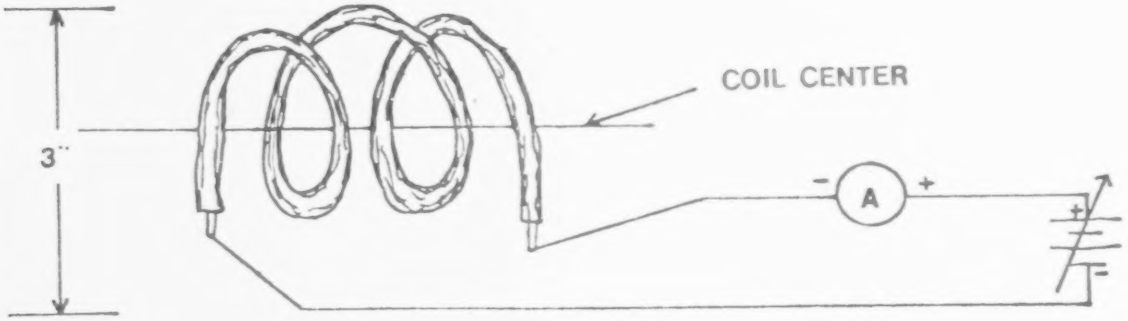
17. Hold a compass near the center of the wire loop arrangement. Touch the negative test lead of the meter to the wire loop while observing the compass. Change the position of the compass to the opposite side of the wire loop. Touch the negative test lead to the wire loop while watching the compasss. The compass should align around the wire as shown in step #18.

Instruction Sheet I (page 3)

18. Reverse the wires attached to the wire loop. Hold the compass near the loop as in step #17. The compass should align around the wire as shown below.



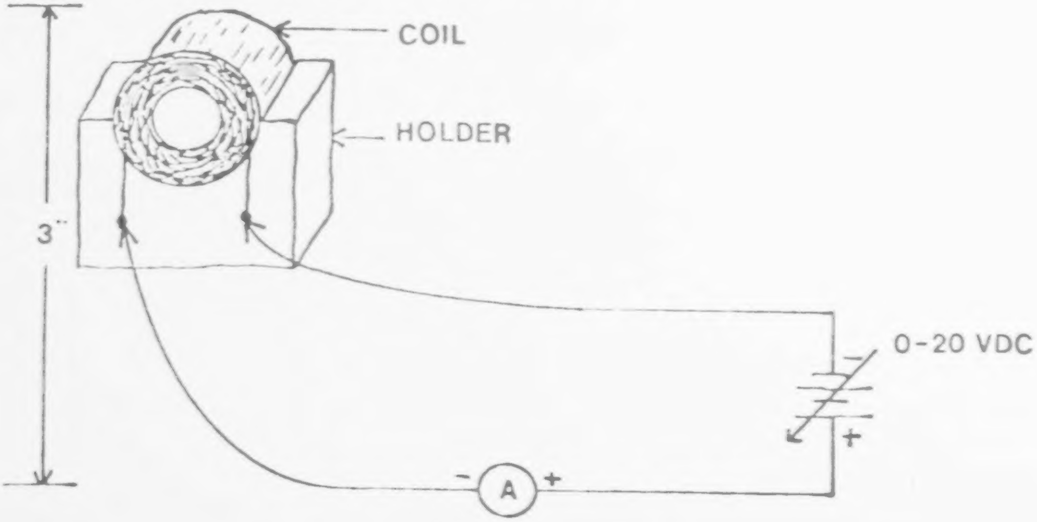
19. With the #12 wire, form a two-turn coil approximately 3" in diameter as shown below. Adjust the power supply until 3 amps of current flows through the coil.



20. Connect the negative lead of the power supply to the coil and pass a compass through the center of the coil while observing the polarity of the compass. The polarities of each end of the loop should be formed as shown below.

21. Reverse the wires attached to the coil. Pass the compass through the coil while observing the compasss polarity. The polarities of the coil should now be developed as shown below.

22. Obtain a coil wound with #18 wire. Connect the coil as shown below. Place a soft iron metal core inside the coil.



Instruction Sheet I (page 4)

23. Adjust the voltage until 1 amp of current flows through the coil.

24. Hold a compass near one end of the metal core. Check the polarities with the compass.

25. Reverse the power supply leads to the coil. Use the compass to check the coil polarities again. They should reverse as compared to Procedure #24.

26. Return all materials to their proper storage area.

INSTRUCTOR'S FINAL CHECKLIST

CHECK FOR MAGNETISM AND ELECTROMAGNETISM

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.	FULLY AC	NOT AC	NOT AP
While developing an understanding of magnetism and electromagnetism, the student:			
1. Selected the proper materials.	____	____	____
2. Used the bar magnets properly.	____	____	____
3. Used the compass properly.	____	____	____
4. Constructed the electromagnet properly.	____	____	____
5. Measured current through the electromagnet correctly.	____	____	____
6. Identified north and south polarities correctly.	____	____	____
7. Performed all tasks in a safe manner.	____	____	____

Appliance Repairer

WORK WITH SERIES CIRCUITS

INTRODUCTION

One of the types of electrical circuits is referred to as a series circuit. In a series circuit there is only one path for current flow. Since there is only one current path, the current flow is the same value in any part of the circuit. The voltages in the circuit depend on the resistance of the components in the circuit. When a series circuit is opened, there is no path for current flow. Thus, the circuit would not operate. In this task assignment you will learn the characteristics of a series circuit.

OBJECTIVE

Given a series electrical circuit and VOM, measure the resistance, voltage, and current values in the circuit. Readings must agree with predetermined values. You will be rated according to the instructor's final checklist.

CHECK-OUT ACTIVITY

Your instructor will provide you with the necessary materials to construct a series electrical circuit. Construct the circuit and use a meter to measure the resistance, voltage, and current values of the circuit.

Learning Activities

1. READ Whirlpool Corporation, Basic Electricity for Appliances, page 25.

   (or) ______________________________

2. OBSERVE a lecture by the instructor on series circuits.
3. CHECK YOUR KNOWLEDGE by completing Student Self-Check I, "Working with Series Circuits."
4. READ Instruction Sheet I, "Working With Series Circuits."
5. PRACTICE working with a series circuit on a unit provided by your instructor.
6. COMPLETE the check-out activities listed for this task assignment. You will be rated according to the instructor's final checklist.

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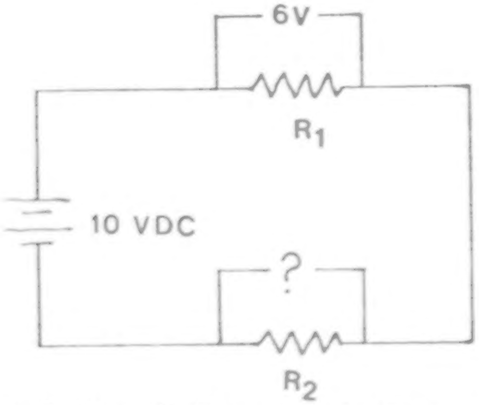
Student Self-Check I

WORKING WITH SERIES CIRCUITS

On a separate sheet of paper, answer the following questions.

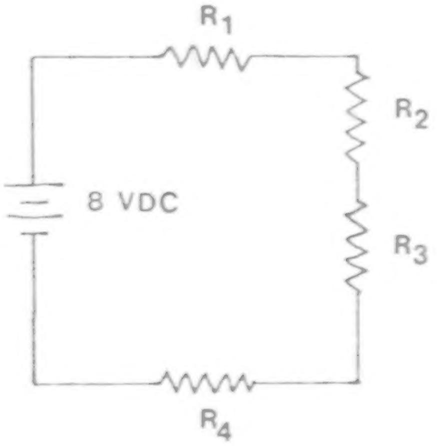
1. What are some of the characteristics of a series circuit?

2. What would be the voltage drop across R_2 in the circuit below?



3. If three resistors 6 Ohm, 8 Ohm, and 10 Ohm were connected in series, what would be their total resistance?

4. In the circuit below, if 2 amps of current is flowing through R_1, how much current is flowing through R_2?



Student Self-Check I (page 2)

5. How many paths for the flow of current are in a series circuit?

6. What is the total voltage drop in the circuit shown in question #41?

7. If three 10 Ohm resistors were connected in series to a voltage source, what part of the voltage would drop across each resistor?

Instruction Sheet I

WORKING WITH SERIES CIRCUITS

MATERIALS:

(1) Volt-Ohm-Milliammeter (VOM)
(2) Variable DC power supply
(3) Resistors (100, 180, 220 Ohm)
(4) Connecting wires

INFORMATION:

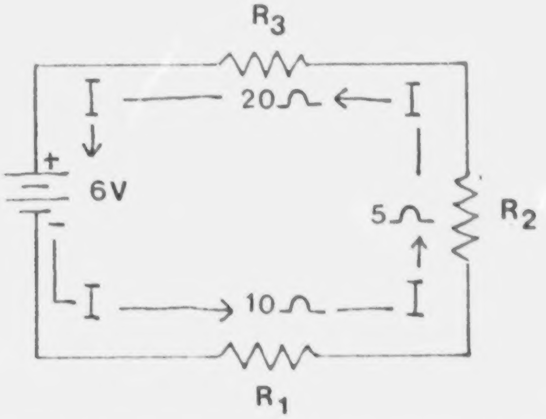
A. There are three types of electrical circuits. These are:

(1) Series circuits
(2) Parallel circuits
(3) Combination circuits

B. The most easily understood electrical circuit is the series circuit. The series circuit has the following electrical characteristics:

(1) There is only one path for the flow of current.
(2) Current is the same value everywhere in the circuit.
(3) The voltage drops, when added together, will equal the voltage applied to the circuit.
(4) The total resistance of the circuit is found by adding the values of all resistances in the circuit.

C. Below is an example of a series circuit.



D. Notice that current (represented by the letter I) has only one path. The current path is from the bottom of the battery (-), through R_1, R_2, and R_3, and then to the top of the battery (+).

Instruction Sheet I (page 2)

E. The amount of current is controlled by the voltage and the total resistance. The total resistance is the sum of the value of all resistors in the circuit. In this circuit, R_1, R_2, and R_3 = Total resistance (R_T) or 10 + 5 + 20 = 35 ohms.

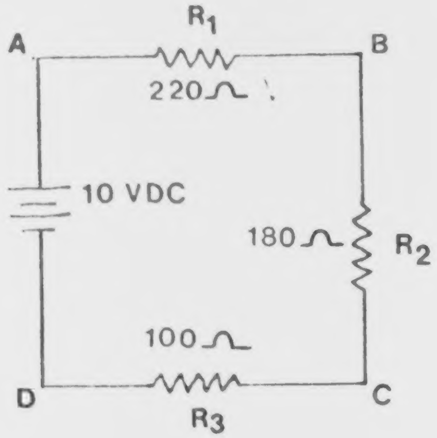
F. Ohm's Law can be used to calculate the current of the circuit:

I = E/R = 6/35 = .171 amperes (171 MA)

Since there is only one path, this means that 171 milliamps of current is flowing through each resistor.

PROCEDUES:

1. Obtain a VOM and the materials necessary to construct the series circuit shown below.



In a series circuit, the total resistance is determined by adding the values of all resistors. The formula used to determine the total resistance of a series circuit is $R_T = R_1 + R_2 + R_3$. Calculated is: R_T = 220 ohm + 180 ohm + 100 ohm = 500 ohms.

2. Prepare your VOM to measure resistance.

3. Disconnect the power supply wires. Connect the VOM across points A and D. Measure the total resistance of the circuit.

4. The measured resistance and calculated resistance should be about the same value. If not, check the values again.

5. Disconnect the VOM and connect the power supply to its orignial location in the circuit.

Instruction Sheet I (page 3)

6. Since you know the total resistance of the circuit, as well as the total voltage, use Ohm's Law to calculate the total current.

   Current = Voltage/Total Resistance = 10V/500 ohm = .02 Amps or 20 MA.

7. Prepare the VOM to measure direct current. NOTE: The value of current calculated in Procedure #6 will help you select the proper meter range.

8. Connect the VOM at Locations A, B, C, and D and measure the current at these points.

   Since the circuit in Procedure #1 is a series circuit, the current is the same through each resistor. You should have seen this in Procedure #8. Since you know the current flow through each resistor and the value of each resistor, you can use Ohm's Law to calculate the voltage drops across each resistor.

9. Prepare the VOM to measure DC voltage. Measure and record the voltage drop across each resistor. Be sure to use the correct meter polarity.

10. Add the three voltage drops which were measured in Procedure #9. This value should be approximately 10 volts.

11. Return all materials to their proper place of storage.

INSTRUCTOR'S FINAL CHECKLIST

WORK WITH SERIES CIRCUITS

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

	FULLY AC	NOT AC	NOT AP
While working with a series circuit, the student:			
1. Selected the proper materials.			
2. Constructed the circuit properly.			
3. Used the meter to measure circuit resistance properly.			
4. Used the meter to measure circuit resistance properly.			
5. Used the meter to measure circuit current properly.			
6. Recorded the measured values correctly.			
7. Performed all tasks in a safe manner.			

Appliance Repairer

WORK WITH PARALLEL CIRCUITS

INTRODUCTION

Parallel electrical circuits have two or more paths for current flow. The voltage is the same across each part of a parallel circuit. The current which flows in any path of a parallel circuit depends upon the amount of resistance in the path. When one of the paths in a parallel circuit is opened, current will still flow through the other paths. The parts of the circuit other than the open path will continue to operate. In this task assignment, you will learn the characteristics of a parallel circuit. Before you begin this task assignment, be sure you have completed AR-12, "Work With Series Circuits."

OBJECTIVE

Your instructor will provide you with the necessary materials to construct a parallel electrical circuit. Construct the circuit and use a meter to measure the resistance, voltage, and current values of the circuit. You will be rated according to the instructor's final checklist.

CHECK-OUT ACTIVITY

Given a parallel electrical circuit and a VOM, measure the resistance, voltage and current values in the circuit. Readings must agree with predetermined values.

Learning Activities

1. READ Whirlpool Corporation Basic Electricity for Appliances, pages 21-22.

   (or) ____

2. OBSERVE a presentation by the instructor on working with parallel circuits.
3. CHECK YOUR KNOWLEDGE by completing Student Self-Check I, "Working With Parallel Circuits."
4. READ Instruction Sheet I, "Working With Parallel Circuits."
5. PRACTICE working with parallel circuits on a unit provided in the shop.
6. COMPLETE the check-out activity listed for this task assignment. You will be rated according to the instructor's final checklist.

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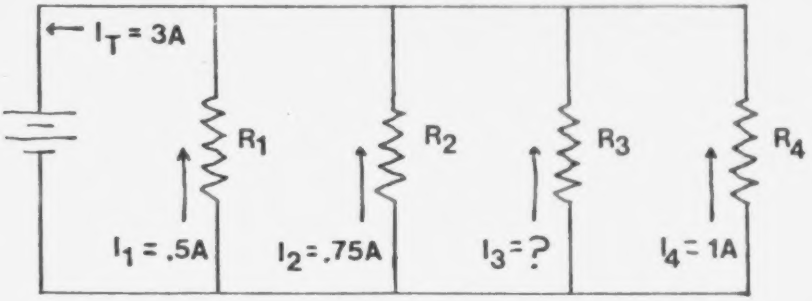
Student Self-Check I

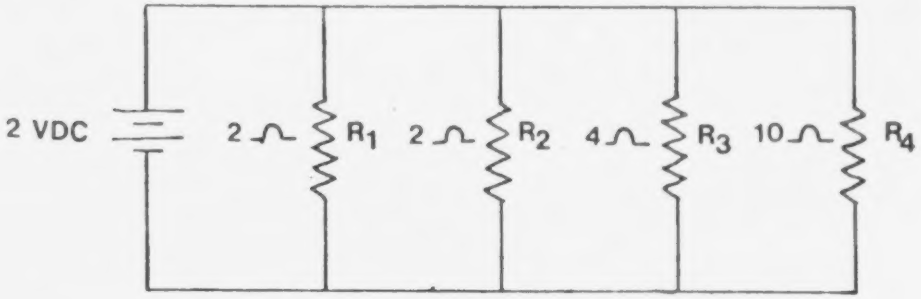
WORKING WITH PARALLEL CIRCUITS

Answer each of the questions below.

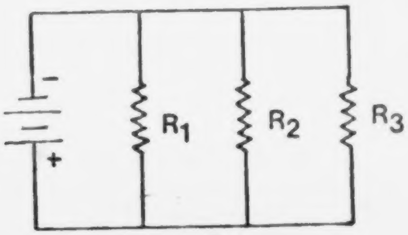
1. List the characteristics of a parallel circuit.
2. What is the current flow through R_3 in the circuit illustrated below?



3. What is the total resistance and total current of the circuit below?



4. What is the voltage across R_2 in the above circuit?
5. If the resistance of each path of a parallel circuit is equal, how will the curent flow in one path compare with the curent in each of the other paths?
6. In the circuit below, show where the VOM should be placed to measure total current. Use an "X" to show where it would be placed.



Student Self-Check I (page 2)

7. In the circuit in #6, indicate where the VOM should be place to measure current thorugh R_2. Use an "O" to show where it would be placed.

Instruction Sheet I

WORKING WITH PARALLEL CIRCUITS

MATERIALS:

(1) Volt-Ohm-Milliammeter (VOM)
(2) Variable DC power supply
(3) Resistors (10, 27, 47 Ohm)
(4) Connecting wires

INFORMATION:

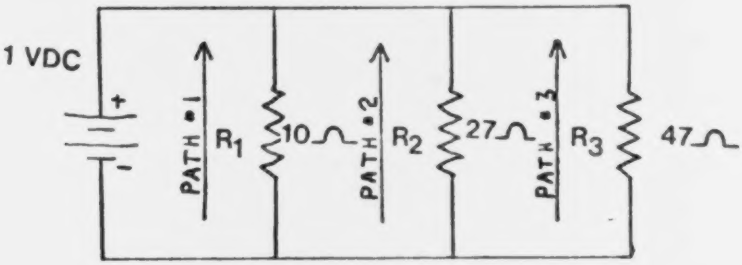
A. Parallel circuits are circuits that have two or more paths for the flow of current. Most of the light fixtures and wall outlets in your home are parallel circuits.

B. Some characteristics of parallel circuits are listed below.

(a) There are two or more paths for the flow of current.
(b) The voltage across each path is the same.
(c) The sum of the currents through each path equals the total current flowing from the voltage source.
(d) The total resistance is calculated by using the following formula: $1/R_T = 1/R_T + 1/R_T + 1/R_2 + 1/R_3$

PROCEDURE:

1. The following is a typical example of a parallel circuit. Construct this circuit.



NOTE: Notice that there are three paths for the flow of current. Also, notice that the voltage across each path is 1 (one) volt.

Instruction Sheet I (page 2)

2. The calculated current flows in each path, and the total current flow for the above circuit, is:

   Path #1 - Current $(I_1) = \dfrac{\text{Voltage (E)}}{\text{Resistance } (R_1)} = \dfrac{1 \text{ volt}}{10 \text{ Ohm}} = .1$ Amps.

   Path #2 - Current $(I_2) = \dfrac{\text{Voltage (E)}}{\text{Resistance } (R_2)} = 1.\text{V}/27$ ohm = .037 Amps.

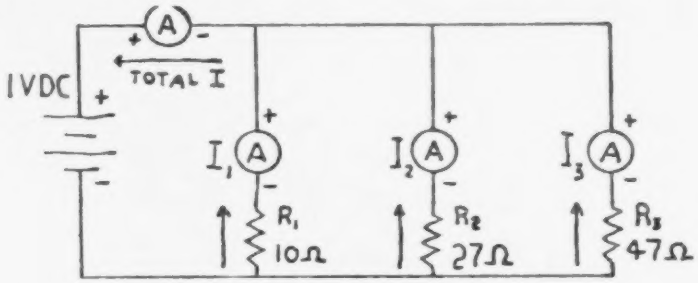
   Path #3 - Current $(I_3) = E/R_3 = 1\text{V}/47$ ohm = .021 Amps.

   Total Current = $I_1 + I_2 + I_3 = .1\text{A} + .037\text{A} + .037\text{A} = .158$ Amps.

3. The calculated total resistance for the circuit shown in procedure # 1 is:

   $$1/R_T = 1/R_1 + 1/R_2 + 1/R_3 = \frac{1}{.1 + .037 + .021} = \frac{1}{.158} = 6.33 \text{ ohm}$$

4. Prepare the VOM to measure direct current. Measure and record the current flow through path #1 (R_1), path #2 (R_2), path #3 (R_3), and the total current in the circuit. The meter should be connected as shown below for each of the measurements. Check with your instructor to make sure you have the meter connected properly in the circuit.



NOTE: The values of current in Procedure #2 should be about the same as the values of current in Procedure #4.

5. Now prepare the VOM to measure DC voltage. Measure and record the voltage across each path of the circuit.

6. Disconnect the power supply. Prepare the VOM to measure resistance of the circuit. Connect the VOM to the wires which previously went to the power supply. Measure the total resistance of the circuit.

   NOTE: The measured total resistance in procedure #6 should be about the same as the calculated total resistance in procedure #3.

7. Return all materials to their proper storage area.

INSTRUCTOR'S FINAL CHECKLIST

WORK WITH PARALLEL CIRCUITS

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

While working with a parallel circuit the student:	FULLY AC	NOT AC	NOT AP
1. Selected the proper materials.			
2. Constructed the circuit properly.			
3. Used the meter to measure circuit resistance properly.			
4. Used the meter to measure circuit voltage properly.			
5. Used the meter to measure circuit current properly.			
6. Recorded the measured values correctly.			
7. Performed all tasks in a safe manner.			

Appliance Repairer

WORK WITH COMBINATION CIRCUITS

INTRODUCTION

Combination electrical circuits are made up of both series and parallel parts. They are sometimes called series-parallel circuits. Almost all electrical equipment has combination circuits rather than only series circuits or only parallel circuits. However, you must understand series and parallel circuits so that you can work with combination circuits. In this task assignment, you will lean the characteristics of combination circuits. Before you begin this task assignment, be sure you have completed AR-13 "Working with Parallel Circuits."

OBJECTIVE

Your instructor will provide you with the necessary materials to construct the circuit and use a meter to accurately measure the resistance, voltage, and current values of the circuit. You will be rated according to the instructor's final checklist.

CHECK-OUT ACTIVITY

Given a combination electrical circuit and a VOM, measure the resistance, voltage, and current values in the circuit. Readings must agree with predetermined values.

Learning Activities

1. READ Whirlpool Corporation, Basic Electricity for Applainces, pages 21-22.

   (or) ______________________________

2. OBSERVE your instructor demonstrate working with combination circuits.
3. CHECK YOUR KNOWLEDGE by completing Student Self-Check I, "Working With Combination Circuits."
4. READ Instruction Sheet I, "Working With Combination Circuits."
5. PRACTICE working with combination circuits on a unit provided by the instructor.
6. COMPLETE the check-out activities listed for this task assignment. Your performance will be rated according to the instructor's final checklist.

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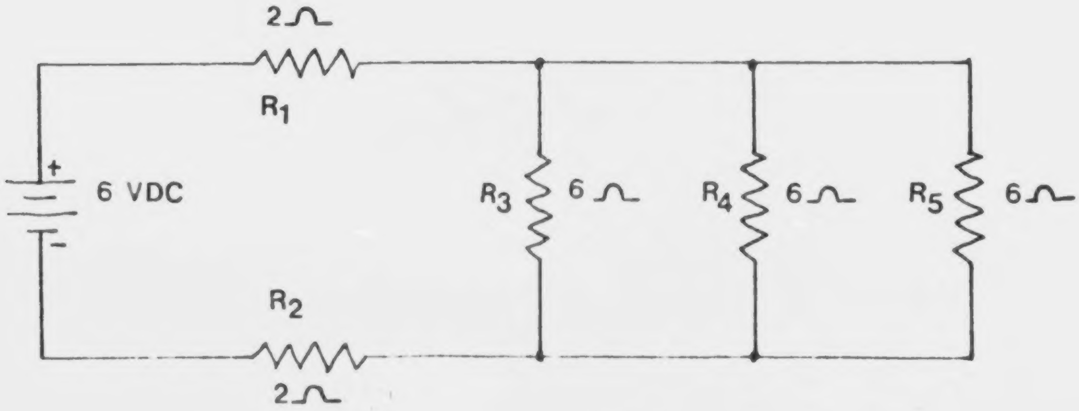
Student Self-Check I

WORKING WITH COMBINATION CIRCUITS

On a separate sheet of paper, answer each of the following questions.

1. How does the total current of a combination circuit compare with the current which flows through its series parts?
2. How does the sum of the currents in the parallel paths of a combination circuit compare with the total current of the circuit?
3. How does the sum of the currents in the parallel paths of a combination circuit compare with the current flow through the series components?
4. How does the sum of the voltages across the series components and the parallel paths of a combination circuit compare with the applied voltage?
5. If you subtracted the voltage across the parallel paths of a combination circuit from the source voltage, how would the results compare with the voltage across the series parts of the circuits?
6. If you added the sum of the resistance of the series parts of a combination circuit to the total parallel resistance of the circuit, how would the results compare with the total resistance of the circuit?
7. For the combination circuit shown below, calculate each of these values:

Total Series Resistance = ____________ ohm
Total Parallel Resistance = ____________ ohm
Total Resistance = ____________ ohm
Total Current = ____________ A
Voltage Across R_1 = ____________ V
Voltage Across R_2 = ____________ V
Voltage Across R_3, R_4, R_5 = __________ V



Instruction Sheet I

WORKING WITH COMBINATION CIRCUITS

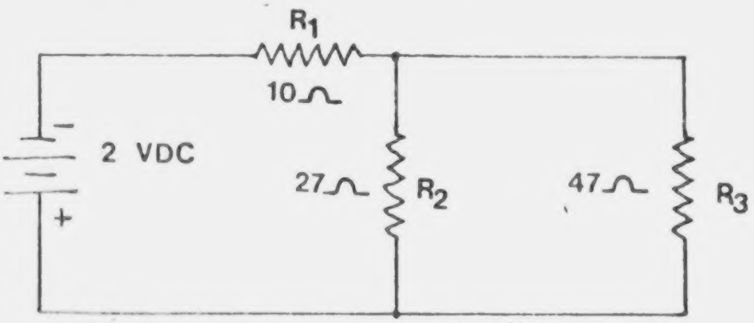
MATERIALS:

(1) Volt-Ohm-Milliammeter (VOM)
(2) Variable DC power supply
(3) Resistors (10, 27, 47 ohm)
(4) Connecting Wires

PROCEDURE:

NOTE: The combination circuit is the most used type of electrical circuit. This type of circuit is a combination of series and parallel circuits. When working with combination circuts you must treat its series part as a series circuit and its parallel part as a parallel circuit.

1. Construct the combination circuit shown below.



2. Prepare the VOM to measure DC voltage. Measure and record the voltage across R_1, R_2, and R_3.

   NOTE: The voltage across R_2 should be the same as the voltage across R_3. R_2 and R_3 must have the same resistance if they are in a series circuit. The sum of the voltage across R_1 and the voltage R_2 or R_3 should equal the applied voltage.

3. Prepare the VOM to measure direct current. Measure and record the current through R_1, R_2, R_3 and the total current.

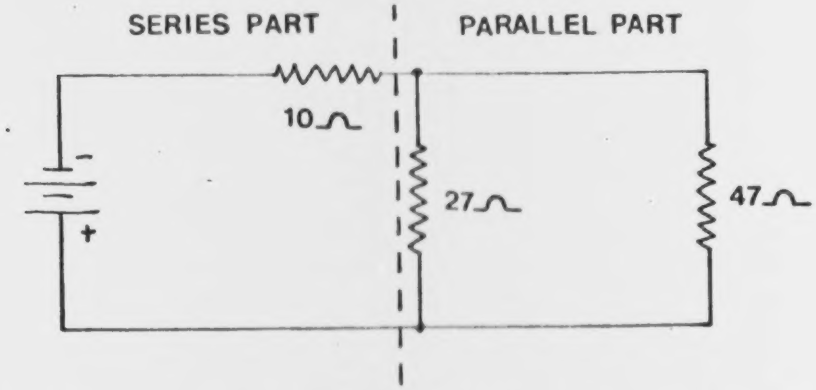
   NOTE: The total current should equal the current flow through R_1. The sume of the currents through R_2 and R_3 should equal the total current of the circuit. The calculated total resistance of the circuit shown in procedure #1 is found by adding the series resistance to the parallel resistance.

Instruction Sheet I (page 2)

Series Resistance = 10 ohm.

$$\text{Parallel Resistance} = \frac{27 \text{ ohm} \times 47 \text{ ohm}}{27 \text{ ohm} + 47 \text{ ohm}} = \frac{1269}{74} = 17.15 \text{ ohm.}$$

Total Resistance = 10 ohm + 17.15 ohm = 27.15 ohm.



4. Disconnect the power supply from the circuit. Prepare the VOM to measure resistance. Connect the VOM to the wires where the power supply was connected. Measure and record the total resistance of the circuit.

NOTE: The measure resistance in procedure #4 should be about the same as the computed resistance in procedure #3. Using Ohm's Law, the calculated total current flow in the circuit is:

$$\text{Total Current} = \frac{\text{Voltage}}{\text{Total Resistance}} = \frac{2\text{V}}{27.15 \text{ ohm}} = .074 \text{ Amps.}$$

The current calculated should be about the same as the current measured in procedure #3.

5. You have found that the sum of the currents through R_2 and R_3 equalled the total current of the circuit. Using the value of total current calculated above and the parallel resistance also calculated above, you can find the voltage drop across the parallel resistors.

NOTE: Voltage Drop across R_2 and R_3 = Current x Parallel Resistance = .074A X 17.15 ohm = 1.26 volts.

The calculated voltage across R_2 and R_3 should be about the same as measured voltage from procedure #2.

Instruction Sheet I (page 3)

6. Using the total current calculated in procedure #4, you can find the voltage drop across R_1.

   NOTE: Voltage Across R_1 = Current X R_1 = .074 X 10 = .74 Volts.

   This calculated voltage should be about the same as measured voltage in procedure #2. The sum of the calculated voltages across R_1 and R_2 or R_3 should equal the source voltage.

7. Return all materials to their proper storage area.

INSTRUCTOR'S FINAL CHECKLIST

WORK WITH COMBINATION CIRCUITS

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

While working with a combination circuit, the student:	FULLY AC	NOT AC	NOT AP
1. Selected the proper materials.	____	____	____
2. Constructed the circuit properly.	____	____	____
3. Identified the series part of the circuit.	____	____	____
4. Identified the parallel part of the circuit.	____	____	____
5. Used the meter to measure circuit resistance properly.	____	____	____
6. Used the meter to measure circuit voltage properly.	____	____	____
7. Used the meter to measure circuit current properly.	____	____	____
8. Recorded the measured values correctly.	____	____	____
9. Performed all tasks in a safe manner.	____	____	____

Appliance Repairer

WORK WITH RELAYS AND SOLENOIDS

INTRODUCTION

Relays and solenoids are electrical devices which rely on magnetism to operate. These devices are sometimes called "actuators." They control other equipment such as motors, lights, or heating elements. Each of these devices uses a small electrical current to control a larger amount of current. In this task assignment you will learn how relays and solenoids operate. Before you start to work on this task assignment, complete "Check for Magnetism and Electromagnetism." APR-011

OBJECTIVE

Given the necessary diagrams and a VOM, check the operation of a relay and construct a solenoid. Solenoid must be operational. Your performance will be rated according to the instructor's final checklist.

CHECK-OUT ACTIVITY

Your instructor will provide you with the necessary diagrams, a relay, materials to construct a solenoid, and a meter. Use the meter to check the operation of the relay and solenoid.

Learning Activities

1. READ Whirlpool Corporation, Basic Electricity for Appliances, pages 57-58 and 121-123.

   (or) ____________________

2. OBSERVE your instructor demonstrate the principles of operation for relays and solenoids.
3. CHECK YOUR KNOWLEDGE by completing Student Self-Check I, "Working With Relays and Solenoids."
4. READ Instruction Sheet I, "Working With Relays and Solenoids."
5. PRACTICE the techniques given in Instruction Sheet I.
6. COMPLETE the check-out activities listed for this task assignment. You will be rated according to the instructor's final checklist.

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Student Self-Check I

WORKING WITH RELAYS AND SOLENOIDS

On a separate sheet of paper, answer each of the following questions.

1. What is a relay?
2. What are the normally open contacts of a relay?
3. What are the normally closed contacts of a relay?
4. What is the "pick-up" current of a relay?
5. What is the "drop out" current of a relay?
6. What is a solenoid?
7. Where are solenoids used?

Instruction Sheet I

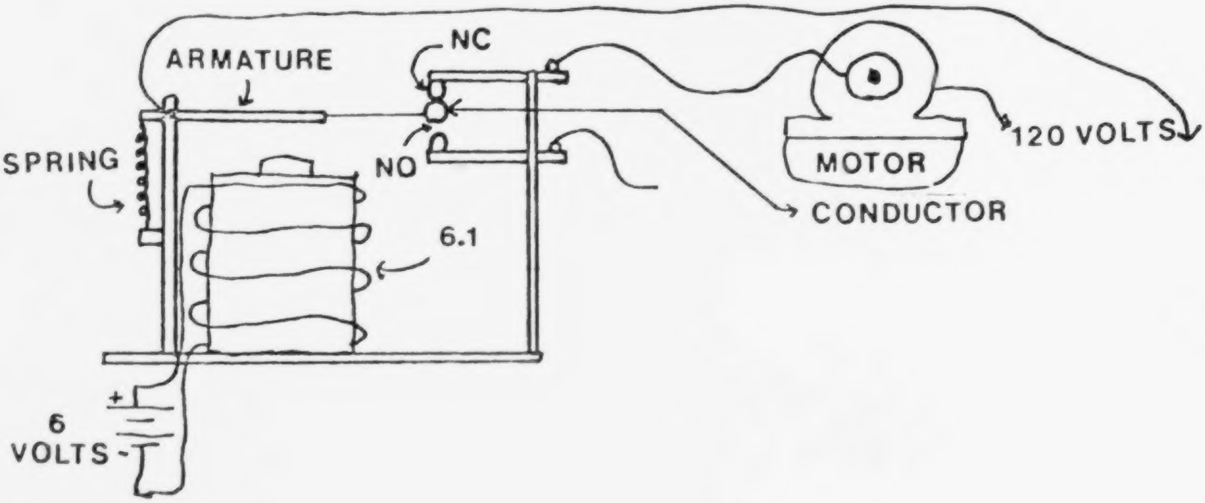
WORKING WITH RELAYS AND SOLENOIDS

MATERIALS:

(1) Volt-Ohm-Milliammeter (VOM)
(2) Relay (1K ohm)
(3) Lamp with socket (6 volt)
(4) Variable DC power supply
(5) Resistor (1K ohm)
(6) Battery (6 volt)
(7) Connecting wires
(8) Wound coil - #24 wire, open center
(9) Soft iron core - 3/4" diameter, 6" long
(10) SPST switch

PROCEDURE:

1. Relays use a small amount of current to cause an electromagnetic field that is strong enough to move a metal strip called a magnet. When the armature is moved, it opens or closes a set of contacts. These contacts can turn on or off circuits that use large amounts of current. The drawing below shows how a relay is constructed.

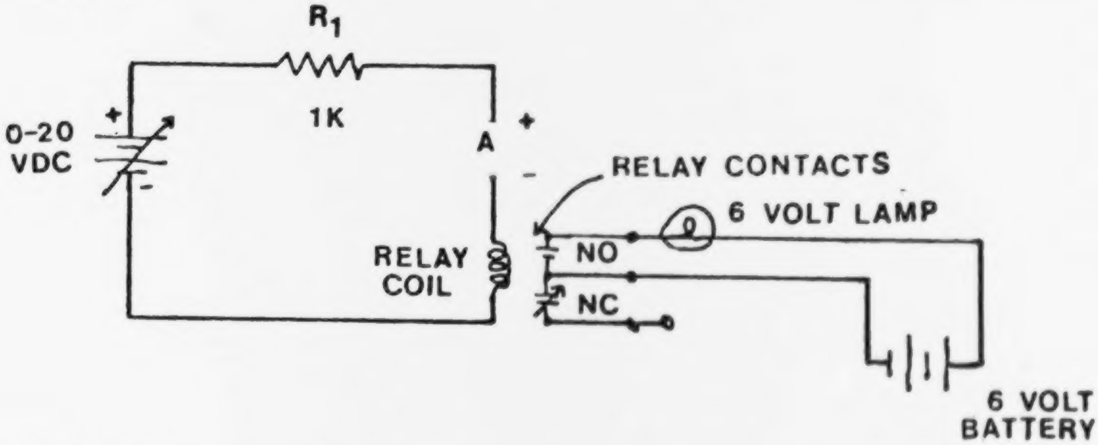


2. Prepare a VOM to measure resistance. Measure and record the resistance of the coil of the relay you are using. This resistance should be marked on the relay.

Instruction Sheet I (page 2)

3. Using the VOM as an ohmmeter, determine how many normally open (NO) and normally closed (NC) contacts are used with your relay. The NO contacts show a resistance reading of infinite and NC contacts show a resistance reading of zero.

4. Construct the circuit shown below. Be sure that the variable DC power supply is adjusted to zero. The VOM should be adjusted to measure DC current.

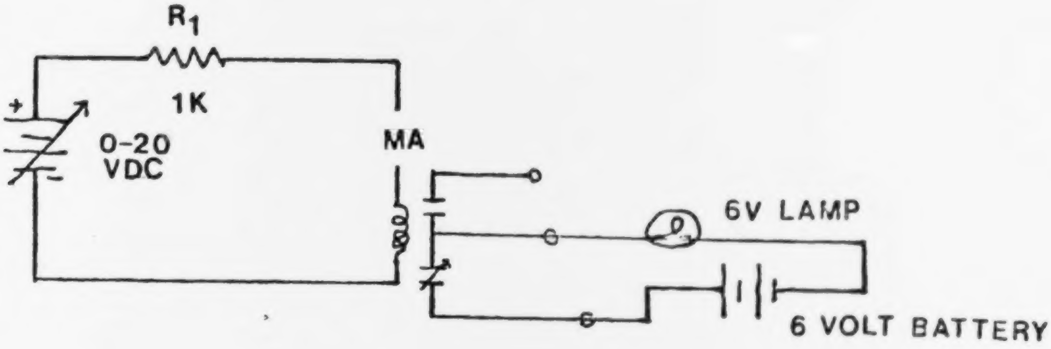

R1
1K
0-20
VDC
+
-
A
+
-
RELAY CONTACTS
6 VOLT LAMP
RELAY
COIL
NO
NC
6 VOLT
BATTERY

5. Slowly adjust the variable DC power supply from zero until the 6 V lamp is turned on. Record the current measured by the VOM that caused the relay to de-energize. This is the "pick-up" current of the relay.

6. Slowly adjust the variable DC power supply toward zero until the 6V lamp is turn off. Record the current measured by the VOM that caused the relay to de-energize. This is the "drop-out" current of the relay.

7. Turn the variable power supply off.

8. Change the circuit as shown below.


R1
1K
+
-
0-20
VDC
MA
6V LAMP
6 VOLT BATTERY

Instruction Sheet I (page 3)

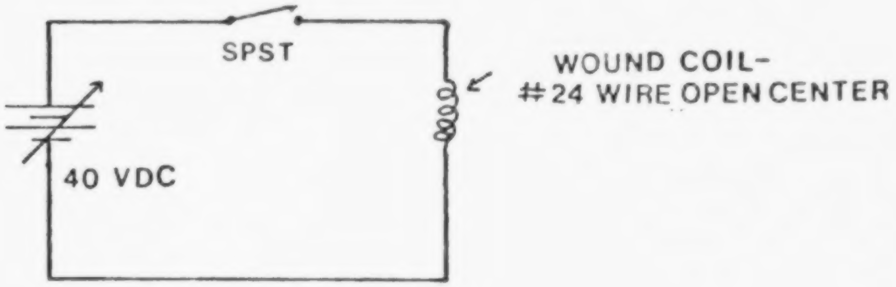
NOTE: The only difference in the two circuits is the contacts that are used. In procedure #4, the NO contacts were used. In this procedure, the NC contacts are used. The lamp will now remain on until the relay is energized.

9. Adjust the variable DC power supply and record the "pick-up" and "drop out" currents as you did in Procedure #5 and 6.

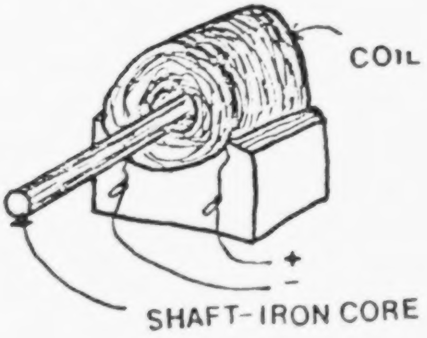
10. Turn off the power supply and disconnect the circuit.

11. Solenoids are electromagnetic coils that have moveable cores constructed of magnetic material. The cores, or plungers, are sometimes attached to a spring. This spring causes the plunger to remain in position until moved by the electromagnetic field when current flows through the coil. This spring also causes the core, or plunger, to return to its original position when the coil is de-energized.

12. To show the operation of a solenoid, construct the circuit shown below.



13. Place about 2" of the end of a soft iron core into the coil as shown below.



Instruction Sheet I (page 4)

14. Close the SPST switch. Do no allow switch to remain closed for over 5 seconds. The soft iron core should move when the switch is closed.

15. Place the bar inside the coil and close the switch. Try to remove the bar with the power on. Do no allow the coil to remain energized for more than 5 seconds. The core will be difficult to move when the switch is turned on.

16. Return all materials to their proper storage area.

INSTRUCTOR'S FINAL CHECKLIST

WORK WITH RELAYS AND SOLENOIDS

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

While working with relays and solenoids, the student:

	FULLY AC	NOT AC	NOT AP
1. Selected the proper materials.			
2. Measured voltage properly.			
3. Measured current properly.			
4. Measured resistance properly.			
5. Identified the "coil" terminals of the relay.			
6. Identified the "normally-open" contacts of the relay.			
7. Identified the "normally-closed" contacts of the relay.			
8. Constructed the solenoid properly.			
9. Performed all tasks in a safe manner.			

Appliance Repairer

CHECK CHARACTERISTICS OF ALTERNATING CURRENT

INTRODUCTION

Much of the electrical energy used today is called alternating current or AC. Much of the electrical equipment and appliances used in homes operate from the alternating current energy which is delivered by power lines. In this task assignment you will learn the characteristics of alternating current (AC) electrical energy. Be sure to complete "Understanding Electrical Components, Symbols, and Diagrams" before starting this task assignment.

OBJECTIVE

Your instructor will provide you with an alternating current power supply, a VOM, and the necessary materials. Construct the alternating current circuits shown in the diagrams and make the measurements which demostrate the characteristics of alternating current electrical energy. You will be rated according to the instructor's final checklist.

CHECK-OUT ACTIVITY

Given an alternating current power supply, a VOM and the necessary materials, make measurements which reveal the characteristics of alternating current. Findings must agree with those of the instructor.

Learning Activities

1. READ Whirlpool Corporation, Basic Electricity for Appliances, pages 61-72.

   (or) ____________________

2. OBSERVE your instructor demonstrate how to check alternating current.
3. CHECK YOUR KNOWLEDGE by completing Student Self-Check I, "Checking Characteristics of Alternating Current."
4. READ Instruction Sheet I, "Checking Characteristics of Alternating Current."
5. PRACTICE checking characteristics of alternating current on a unit provided by the instructor.
6. COMPLETE the check-out activity listed for this task assignment. Your performance will be rated according to the instructor's final checklist.

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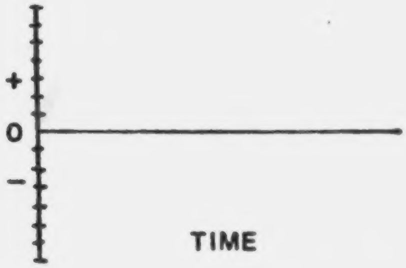
Student Self-Check I

CHECKING CHARACTERISTICS OF ALTERNATING CURRENT

On a separate sheet of paper, answer the following questions.

1. Draw a sine wave on the graph shown. Mark the following: 90°, 180°, 270°, 360°, + peak, - peak, and peak-to-peak.



2. What is the standard frequency of the alternating current used in the United States?
3. What is alternating current?
4. How does the power produced by 10 VDC compare to the power produced by 10 VAC RNS across the same resistance?
5. Define the following terms: (1) Hertz, (2) Frequency, and (3) Cycle.

Instruction Sheet I

CHECKING CHARACTERISTICS OF ALTERNATING CURRENT

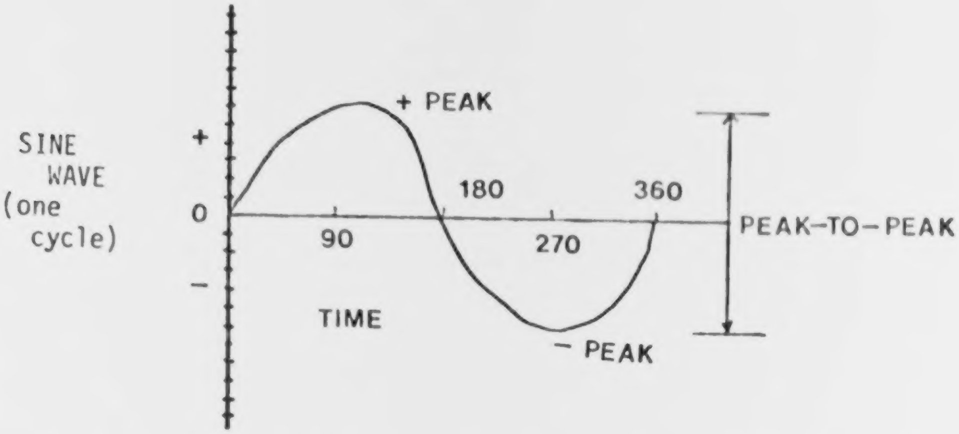
MATERIALS:

(1) Volt-Ohm-Milliammeter (VOM)
(2) Variable AC-DC power supply
(3) SPST switch
(4) DPST switch
(5) 6 volt lamp with socket
(6) Resistors (10, 22, 33 Ohm)
(7) Connecting wires
(8) 6 volt battery

INFORMATION:

A. Alternating Current (AC) is the most common form of electrical energy used in the United States today. It is called alternating current because it changes direction of current flow several times in a given unit of time. The most used unit of time for AC is the second.

B. A diagram of alternating current (AC) is shown below. This is called a sine wave of alternating current.



C. The sine wave above represents one cycle of AC. The term cycle comes from the word circle. It means a sequence that begins and ends at the same point. In this case, the point of beginning and ending is zero. A cycle, like a circle, is divided into 360°. EAch one-fourth of a cycle is equal to 90°.

D. The number of AC cycles per second is known as frequency. This is the number of times in one second that AC passes from zero, reaches a peak in on direction, changes its direction, reaches a peak in the other direction, and goes back to zero. Cycles per second (cps) are measured in Hertz (Hz).

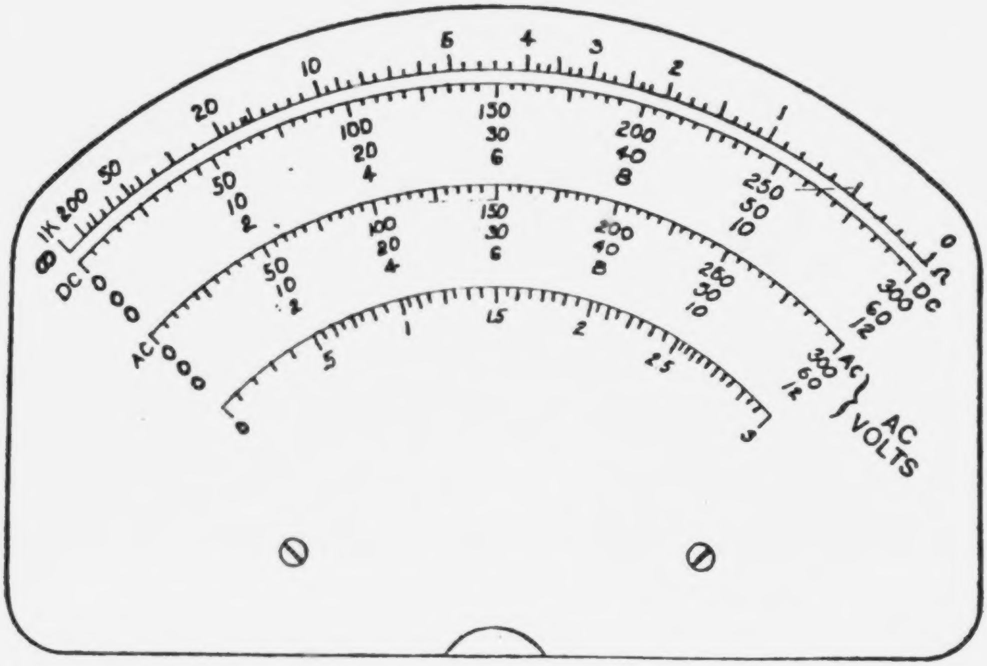
Instruction Sheet I (page 2)

E. In this activity, you will used the same VOM that was used in previous activities. This time you will measure AC voltage. AC voltage is measured in the same way as DC voltage with two exceptions:

(1) When measuring AC voltage, proper polarity does not have to be observed.

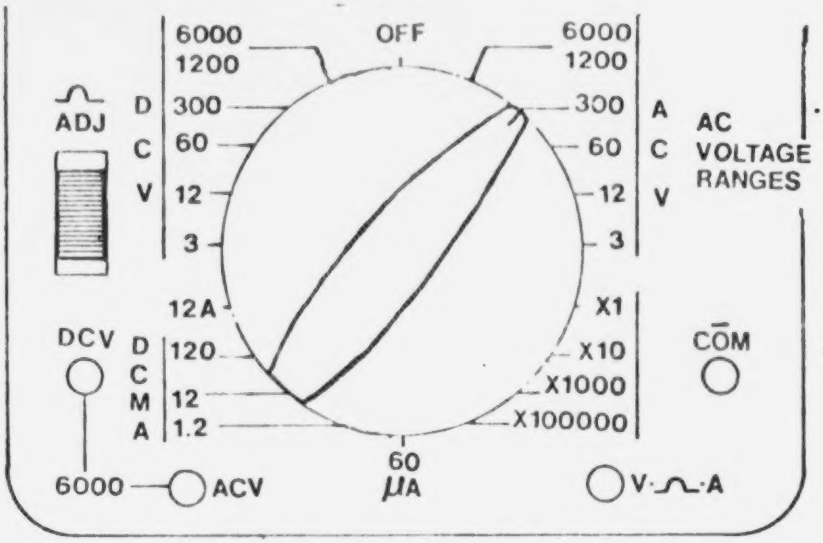
(2) When measuring AC voltage, the AC voltage ranges and scales of the meter must be used.

The following diagrams shows the scales of a commonly used VOM. The AC voltage scales are marked on the diagram below.


∞
1K
200
50
20
10
5
4
3
2
1
0
Ω
DC
0
50
10
2
100
20
4
150
30
6
200
40
8
250
50
10
300
60
12
DC
AC
0
50
10
2
100
20
4
150
30
6
200
40
8
250
50
10
300
60
12
AC
0
.5
1
1.5
2
2.5
3
AC VOLTS

Instruction Sheet I (page 3)

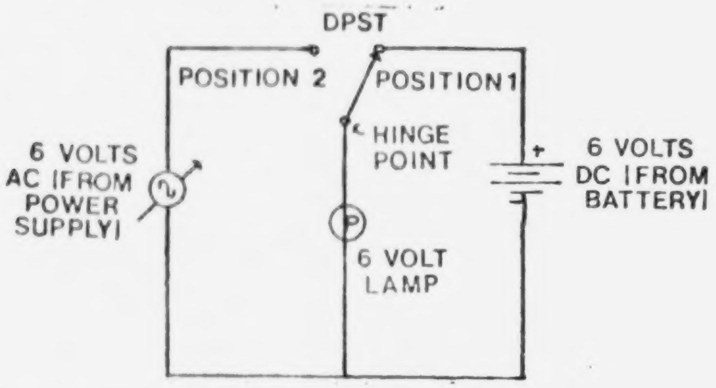
The function select switch of the meter must be adjusted to AC voltage as shown below. Alternating current cannot be measured with this VOM.


6000
1200
OFF
6000
1200
ADJ
D
C
V
300
60
12
3
300
60
12
3
A
C
V
AC
VOLTAGE
RANGES
12A
DCV
D
C
M
A
120
12
1.2
X1
X10
X1000
X100000
COM
6000
ACV
60
μA
V·Ω·A

Function Select Switch

PROCEDURE:

1. Construct the circuit shown below. Be sure to find the hinge point of the switch. Adjust the power supply to 6 volts AC and connect as shown.


DPST
POSITION 2
POSITION 1
HINGE POINT
6 VOLTS AC (FROM POWER SUPPLY)
+
6 VOLTS DC (FROM BATTERY)
6 VOLT LAMP

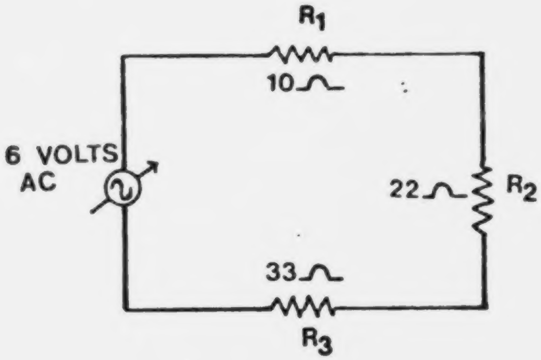
2. Place the DPST switch in position #1. Measure the DC voltage across th 6V lamp. With the VOM, record the value of this voltage.

3. Place the DPST switch in position #2. Measure the AC voltage across the lamp. Record the AC voltage value.

Instruction Sheet I (page 4)

4. Slowly change the DPST switch from position #1 to position #2 several times. The brightness of the bulb should not be affected. This shows that AC and DC have the same effect.

5. Disconnect the circut and construct the circuit shown below.



6. Using the VOM to measure AC voltage, complete the chart below. Use the formulas shown for the calculations.

Resistor Number	Measured Voltage Across Resistor	Calculated Peak Voltage Across Resistor (Measured Voltage x 1.41)	Calculated Peak-to-Peak Voltage Across Resistor (Measured Voltage x 2.82)
R_1			
R_2			
R_3			

7. Return all materials to their proper storage area.

INSTRUCTOR'S FINAL CHECKLIST

CHECK CHARACTERISTICS OF ALTERNATING CURRENT

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

While developing an understanding of alternating current, the student:

	FULLY AC	NOT AC	NOT AP
1. Selected the proper materials.			
2. Constructed the circuits properly.			
3. Measured AC voltage correctly.			
4. Measured AC current correctly.			
5. Measured resistance correctly.			
6. Calculated values of AC power properly.			
7. Performed all tasks in a safe manner.			

Appliance Repairer

CHECK CAPACITORS

INTRODUCTION

Some types of home appliance equipment have capacitors. This makes it necessary for the appliance repair serviceman to know how to check capacitors. There are basically two types of capacitors on most equipment, the start capacitor and the run capacitor. In this task assignment, with the use of an ohmmeter, you will learn how to check capacitors.

OBJECTIVE

Using the unit provided by your instructor, check the capacitor(s). You will be rated according to the instructor's final checklist.

CHECK-OUT ACTIVITY

Given a unit with a suspected faulty capacitor(s), a volt-ohmmeter and necessary supplies, check capacitor(s). Your analysis should match predetermined findings.

Learning Activities

1. READ Doolin, Doolin's Trouble Shooter's Bible, pages 15-17.

   (or) ____________________

2. OBSERVE your instructor demonstrate the procedure for checking capacitors.
3. CHECK YOUR KNOWLEDGE by completing Student Self-Check I, "Capacitors."
4. READ Instruction Sheet I, "Checking Capacitors."
5. PRACTICE checking capacitors by following the procedure outlined in Instruction Sheet I.
6. COMPLETE the check-out activity listed for this task assignment. Your performance will be rated according to the instructor's final checklist.

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Student Self-Check I

CAPACITORS

On a separate sheet of paper answer the following questions.

1. The capacitor in an alternating current circuit basically changes a ______________ phase electrical flow to a _____________ phase electrical flow.

2. The capacitor is usuable in both the ___________ winding and the ____________ winding of a motor.

3. Name the types of capacitors and indicate which is designed for the type of operation indicated.

   a. ________________ capacitor for intermittent operation.
   b. ________________ capacitor for continuous operation.

4. What type of capacitor should you NEVER use in a running circuit?

5. Always use the correct __________ and the correct __________ capacity when replacing a capacitor.

6. In a current relay hook-up, the start capacitor is connected between the relay contacts and terminal _________ (C, S, R) of the compressor motor.

7. In a potential relay hook-up, the start capacitor is connected between the relay contacts and terminal ___________ (C, S, R) of the compressor motor.

8. In a permanent split capacitor (PSC) motor hook-up, the run capacitor is connected between terminal _________ (C,S,R) and terminal ____________ (C, S, R) of the compressor motor.

9. There are four methods of testing a capacitor mentioned in the text references for this module. They are:

   a.
   b.
   c.
   d.

Student Self-Check I (page 2)

10. Before we begin to check a capacitor, we should always ______________ the capacitor. charge, discharge

11. When checking a capacitor with an ohmmeter, the following three readings are an indication of a (good, open, shorted) capacitor.

   a. ______________ - continuous low resistance or (0) Zero reading.
   b. ______________ - a deflection of the meter pointer to (0) Zero and back to (oo) Infinity reading.
   c. ______________ - no movement of the pointer; it remains on (oo) Infinity reading.

12. When checking with an ohmmeter to further assure that the capacitor is satisfactory, we __________ the leads of the ohmmeter on the capacitor terminals. The resultant deflection should be approximately __________ times that of the first check. (2, 3, 4)

13. When checking a capacitor by exposing it to voltage and then discharging the capacitor, the following three things are an indication if a (good, open, shorted) capacitor.

   a. ______________ it will spark.
   b. ______________ the fuse will blow.
   c. ______________ it will not spark.

14. When using the preceeding method to check a capacitor, we should put the capacitor in a PROTECTIVE CASE while testing it because a/an ____________ capacitor may ____________ when we put it into the circuit. shorted/open explode/burn

Instruction Sheet I

CHECKING CAPACITORS

WARNING: SAFETY FIRST! Currents and/or voltages that you may be exposed to in working with capactiors could produce a fatal shock. Be sure you understand what you are doing before you do it. Always use CAUTION when working with electricity.

1. The first step in doing any job right is to have the necessary tools and supplies to do the job. You will need:

   a. Safety glasses
   b. Screwdrivers
   c. Needlenose pliers
   d. Rosin core solder
   e. Soldering iron
   f. Bleeder resistor
   g. Volt-ohmmeter

2. Your instructor will provide you with a unit on which to perform this operation.

3. Turn the power off or unplug the power cord to the unit.

4. Study the unit and determine how many and what type of capacitors are on the unit.

5. After you have located the capacitor(s) on the unit, DISCHARGE THE CAPACITOR WITH A BLEEDER RESISTOR.

6. With a screwdriver or soldering iron (depending on type of terminals on the capacitor), remove the wires from the capacitor.

7. Set up your ohmmeter by turning the range selector switch to the proper resistance scale (R X 100 - R X 1000 or higher) and calibrate the ohmmeter to zero reading by shorting the leads of the ohmmeter together. Use lower scale to check start capacitors and high scales to check run capacitors.

8. Touch the meter leads across the capacitor and observe scale reading for one of the following:

   a. Full scale (zero) and drop back slowly indicating a good capacitor.
   b. Full scale (zero) and not drop back indicating a shorted capacitor.
   C. No scale reading (infinity) indicating an open capacitor.

   NOTE: It may be necessary to REVERSE your ohmmeter leads across the capacitor to obtain satisfactory results with this task.

Instruction Sheet I (page 2)

9. When checking run capacitors, you will also have to check for a grounded capacitor. Locate the identified terminal on the run capacitor (a red dot, a minus (-), or plus (+), etc.). You will place your ohmmeter leads across this terminal and the can or container of the run capacitor.

   CAUTION: Some run capacitor containers are painted. If this is the case, it will be necessary to scratch off a little paint in the area where you make your check so as to have electrical continuity.

   (If the particular capacitor you are checking does not have a marked terminal, you will need to check across both terminals to the can or container of the capacitor.

10. Set your ohmmeter up to R X 1000 or higher and place one lead on the capacitor terminal and one lead on the capacitor container. Observe the scale reading of one of the following.

    a. Full scale (zero) and not drop back indicating a grounded capacitor.
    b. No scale reading (infinity) indicates a capacitor that is not grounded or in other words, indicates the capacitor is good.

11. Record your results of the test on paper as they must match predetermined findings.

12. Be sure to re-connect any wires taken loose while making these checks, as this presents an ELECTRICAL SAFETY HAZARD if not connected. The marked terminal of the run capacitor should be connected to the (R) terminal of the compressor motor.

INSTRUCTOR'S FINAL CHECKLIST

CHECK CAPACITORS

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

While checking capacitors, the student:

	FULLY AC	NOT AC	NOT AP
1. Selected the proper tools and supplies to do the job.	____	____	____
2. Followed the proper procedure to:			
a. Calibrate his ohmmeter to the proper scale.	____	____	____
b. Discharge the capacitors before checking.	____	____	____
c. Disconnecte the proper wires to the capacitor(s) for checking.	____	____	____
3. Recorded the correct results as per predetermined findings.	____	____	____
4. Followed the necessary safety precautions.	____	____	____

TASK ASSIGNMENT SHEET APR-018

Appliance Repairer

SPLICE WIRES

INTRODUCTION

The appliance repair technician frequently will be required to splice electrical wiring. The joining of wires in an electrical circuit must be made in a manner approved by the National Electric Code.

OBJECTIVE

You will mechanically splice, solder, and insulate electrical wiring using materials provided by the instructor. Your performance will be rated according to the instructor's final checklist.

CHECK-OUT ACTIVITY

Provided with wire, tools, and equipment by the instructor, splice wires so the connection does not short, insulation is not frayed, and voltage does not drop across the connectors.

Learning Activities

1. READ Meyerink, G., Appliance Service Handbook, page 180.

   (or) ______________________________

2. OBSERVE a demonstration by your instructor on splicing, soldering, and insulating electric wiring.
3. PRACTICE making splices in wiring using tools and materials provided by the instructor.
4. COMPLETE the check-out activity listed for this task assignment. You will be rated according to the instructor's final checklist.

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INSTRUCTOR'S FINAL CHECKLIST

SPLICE WIRES

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In making wire splices, the student performed the following:

	FULLY AC	NOT AC	NOT AP
1. Disconnected power.			
2. Trimmed ends of wire.			
3. Properly connected ends of wires.			
4. Insulated splice.			
5. Reconnected power and tested for performance.			
6. Cleaned work area and stored materials.			

Appliance Repairer

WORK WITH SINGLE-PHASE AC INDUCTION MOTORS

INTRODUCTION

Single-phase AC induction motors are used for many purposes in the home. They are used to drive blowers for air conditoners and for many other smaller applications. The most used type of single-phase AC motors is called an induction motor. This type includes split-phase motors and capacitor motors. It is important to know the characteristics of these motors and how to test them for proper operation. In this task assignment, you will learn the characteristics of single-phase AC induction motors and how to test them. Be sure to complete "Checking Characteristics of Alternating Current" before starting this task assignment.

OBJECTIVE

Your instructor will provide you with a single-phase AC induction motor, a meter, and necessary materials. Make the proper measurements to check the operation of the motor. You will be rated according to the instructor's final checklist.

CHECK-OUT ACTIVITY

Given a single phase AC induction motor, a meter, and the necessary materials, make the proper measurements to check the operation of the motor. Findings must agree with motor Name/Data Plate.

Learning Activities

1. READ Whirlpool Corporation, Basic Electricity for Appliances, pages 99-101 and 105-110.

   (or) ______________________________

2. OBSERVE your instructor demonstrate working with single-phase AC induction motors.

3. CHECK YOUR KNOWLEDGE by answering on a separate sheet of paper Student Self-Check I, "Working With Single-Phase AC Induction Motors."

4. READ Instruction Sheet I, "Working With Single-Phase AC Induction Motors."

5. PRACTICE working with a single-phase AC induction motor provided by the instructor. Follow the procedure outlined in Instruction Sheet I.

6. COMPLETE the check-out activity listed for this task assignment. You will be rated according to the instructor's final checklist.

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Student Self-Check I

WORKING WITH SINGLE-PHASE AC INDUCTION MOTORS

On a separate sheet of paper, answer the following questions.

1. How is starting torque developed in an AC split-phase motor?
2. Draw simplified diagrams of a dual voltage (120/240 volt) motor showing how its windings are connected, first for 120 volt operation and then the 240 volt operation.
3. If a motor had two running windings (poles), what is its synchronous speed? The frequency is 60 Hertz.

   $$\text{SYNCHRONOUS SPEED (RPM)} = \frac{\text{AC Frequency} \times 120}{\text{Number of Poles}}$$

4. When looking at the stator windings of an AC split-motor, how do you know which sets of coils are the run windings and which are the start windings?
5. How do the values of starting and running curent of an AC induction motor compare? Why?
6. What effect does increased load have on speed and current of a motor?
7. How is the direction of rotation of a split-phase or capacitor motor reversed?

Instruction Sheet I

WORKING WITH SINGLE-PHASE AC INDUCTION MOTORS

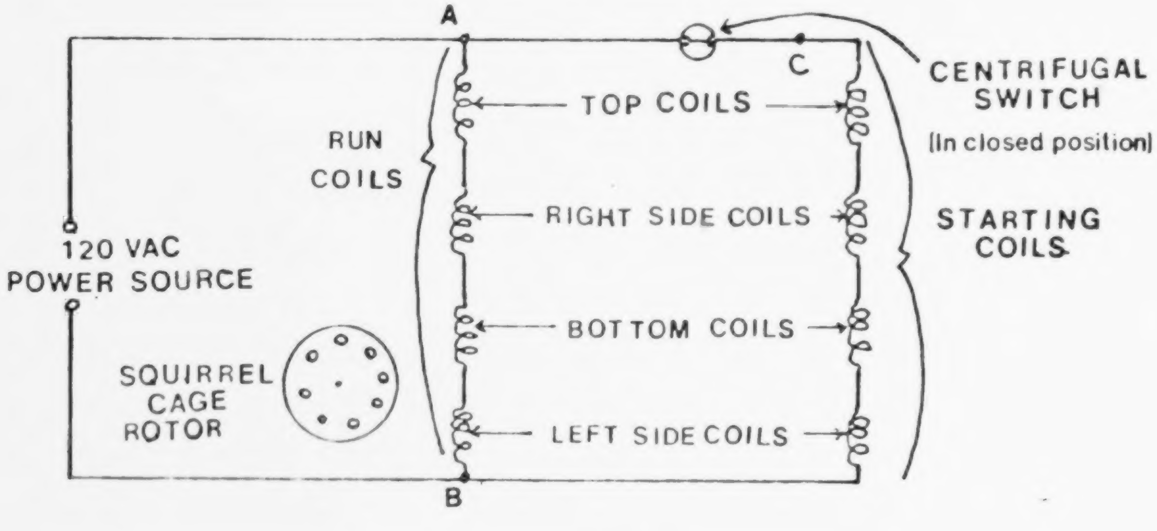
MATERIALS:

(1) AC Split-Phase Induction Motor or AC Capacitor-Start Induction Motor
(2) AC Power Source (same as motor's rated voltage)
(3) Tachometer
(4) AC Ammeter
(5) Volt-Ohm-Milliammeter (VOM)

INFORMATION:

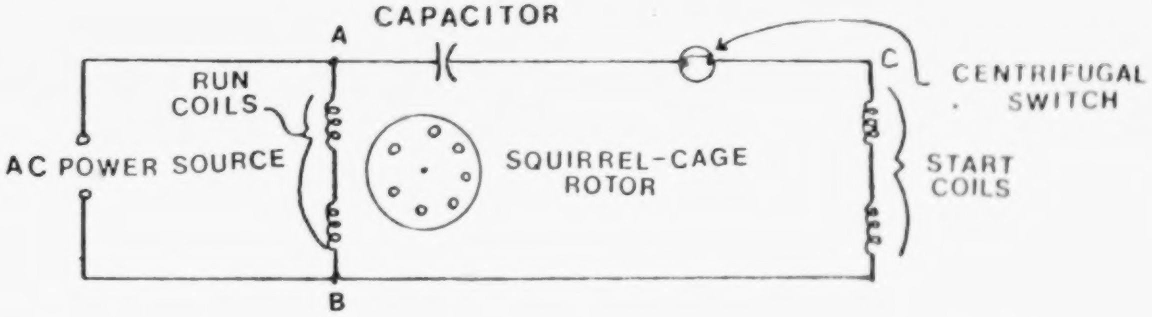
A. Single phase AC motors are usually classified according to their method of starting. A very common starting method used by single phase motors is phase splitting. In this method, windings of different sizes are used to shift the phase of AC in such a way that it will produce rotation. This type of motor runs on what is called the induction principle. Once rotation is started and the rotor reaches 75% of its running speed, the starting circuit is no longer needed. Most starting circuits are removed after being in the circuit for only a few seconds by a switch mechanism. The switch is mounted on the rotor shaft. It operates oncentrifugal force and is used to disconnect the starting circuit from the power source.

The connection diagram for an AC split-phase induction motor is shown below (Fig. A).


A
C
CENTRIFUGAL SWITCH
(In closed position)
TOP COILS
RUN COILS
RIGHT SIDE COILS
STARTING COILS
120 VAC POWER SOURCE
BOTTOM COILS
SQUIRREL CAGE ROTOR
LEFT SIDE COILS
B

Instruction Sheet I (page 2)

A connection diagram for an AC capacitor-start induction motor is shown below.



B. There are several modification of the above diagrams; however, the run windings and start windings are always connected in parallel. The centrifugal switch is in series with the start windings. Dual voltage motors (120/240 Volt, for example) have two sets of run windings. They are connected in parallel for low voltage operation and in series for high voltage operation.

PROCEDURE:

1. Obtain a split-phase or capacitor-start AC motor. Find the motor nameplate and record the information given on the identification plate (nameplate).
2. Determine the type of motor you are working with. (You may need to check with your instructor.)
3. Look at the motor windings. You may have to remove one of the end housings to see the windings. Notice how they are wound into the slots of the stator. The largest diameter wire is the run windings and the smallest wire is the start windings.
4. Count the number of start and run windings around the stator assembly.
5. Most motors have a mounting strip where the wires from the windings are connected. Locate this strip on your motor.
6. Disconnect the necessary wires to make the following resistance measurements. Use a low resistance range of the meter. Measure and record run winding resistance (point A to point B on the diagram of Fig. A.) and start winding resistance (point C to point B).
7. Make sure all wires are properly connected back onto the motor so that it will be operational. Connect an AC ammeter in series with the 120 VAC lines of the motor. (Remember that most VOM's do not measure AC current.)

Instruction Sheet I (page 3)

8. Apply the rated voltage to the motor by plugging it into a power outlet. Observe and record the starting current drawn by the motor when it is first turned on. The meter needle will move to the right and then back to the left. Record the highest current that the meter indicated.

9. Now, record the current flow indicated when the motor is running with no load connected to its shaft.

10. Connect a tachometer to the motor's shaft. Measure and record the motor's operating speed.

11. Carefully apply a load to the motor's shaft. The motor speed should decrease and the current should increase.

12. Turn off the power and reverse the direction of rotation of the motor. This is done by reversing the two wires of the start winding where they connect to the mounting strip. (Check with your instructor if necessary.)

13. Turn on the power and test the motor for operation in the reverse direction. Measure and record the line current and speed.

14. Turn off the power and connect the motor windings as they were when you started working with it.

15. Return all materials to their proper storage area.

INSTRUCTOR'S FINAL CHECKLIST

WORKING WITH SINGLE-PHASE AC INDUCTION MOTORS

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

While working with single-phase AC induction motors, the student:

	FULLY AC	NOT AC	NOT AP
1. Selected the proper tools.			
2. Identified the motor's start windings.			
3. Identified the motor's run windings.			
4. Measured starting current properly.			
5. Measured running current properly.			
6. Loaded the motor correctly.			
7. Recorded the motor nameplate data correctly.			
8. Reversed the motor's direction of rotation correctly.			
9. Performed all tasks in a safe manner.			

Appliance Repairer

REPLACE DIGITAL COMPONENT

INTRODUCTION

Digital components are usually arranged on a card for some control function in an electrical circuit. Troubleshooting and maintenance for digital components are exact, often complex procedures. Caution must be exercised in handling and testing digital components. This task assignment will provide you with the necessary skills to enable you to successfully replace a digital component.

OBJECTIVE

Given an appliance with a digital control circuit, proper tools, and manufacturers repair/service manual, you will replace a digital component. You will be evaluated according to the Instructor's Final Checklist.

CHECK-OUT ACTIVITY

Your instructor will provide an appliance with a digital controller, proper tools, a replacement component, and the manufacturer's repair/service manual. You will replace a defective digital component that will restore operation to meet the manufacturer's specifications.

Learning Activities

1. READ Industrial Electronics and Robotics, Schuler and McNamee, McGraw-Hill, 1986. pp. 308-310.

   (or) Manufacturer's Repair/Service Manual

2. OBSERVE your instructor demonstrate how to replace a digital component in an Electronic Control Circuit.

3. PRACTICE replacing a digital component by following the procedures in Instruction Sheet #1.

4. COMPLETE the check-out activity for this task assignment. You will be rated according to the Instructor's Final Checklist.

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INSTRUCTION SHEET I

REPLACE DIGITAL COMPONENT

1. Disconnect appliance from power supply.
2. Remove control panels.
3. Remove defective component.
4. Drain static electricity from body and replacement component through approved ground.
5. Install replacement component.
6. Reassemble appliance.
7. Clean up work area and store tools.

INSTRUCTOR'S FINAL CHECKLIST

REPLACE DIGITAL COMPONENT

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In replacing a digital component, the student performed the following:

	FULLY AC	NOT AC	NOT AP
1. Disconnected power supply.	____	____	____
2. Removed control panel.	____	____	____
3. Removed defective digital component.	____	____	____
4. Drained static electricity from body and replacement component.	____	____	____
5. Installed replacement component.	____	____	____
6. Reassembled appliance.	____	____	____
7. Cleaned work area and stored tools.	____	____	____

Appliance Repairer

USE SOFT SOLDER TO JOIN METAL FITTINGS

INTRODUCTION

Soldering is a method of joining or bonding two pieces of metal together by melting and flowing another metal or combination of metals of a lower melting temperature between the other two surfaces. In soft soldering, molten metal usually consists of a combination of lead and tin in proportions of fifty percent each or ninety-five percent tin and five percent antimony. In appliance repair and servicing, you will often need to join or repair tubing and other metals by this method. In this task assignment, you will learn to join fittings to copper tubing using the soft solder method.

OBJECTIVE

Given copper tubing and fittings, soft solder, soldering flux, flux brush, abrasive cloth, file, and a soldering torch, soft solder copper tubing to a fitting to form a joint. The joint must withstand pressure for systems presssure test after completion. A checklist will be used to rate your performance. All items on the checklist must be fully accomplished.

CHECK-OUT ACTIVITY

Obtain the proper tubing and fitting from your instructor. Soft solder the copper tubing to the fitting to form a joint. The instructor should observe your work.

Learning Activities

1. READ Meyerink, G., Appliance Service Handbook, pages 178-179.

   (or) ______________________________

2. OBSERVE your instructor demonstrate proper techniques in using soft solder to join metal.
3. CHECK YOUR KNOWLEDGE by completing on a separate sheet of paper, Student Self-Check I, "Soft Soldering." Have the instructor check your answers.
4. PRACTICE soft soldering techniques by building and testing the assembly designated by your instructor.
5. COMPLETE the check-out activities listed for this task assignment. You will be rated according to the instructor's final checklist.

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Student Self-Check I

SOFT SOLDERING

On a separate sheet of paper, number from 1 to 10. Write "T" for the statements that are True and write "F" for the statements that are False. After you complete this, have your instructor check your responses.

_____ 1. Safety glasses should always be worn when soldering.

_____ 2. 50/50 solder is recommeded for high temperature applications.

_____ 3. 95/5 solder may be used in certain applications where operating temperatures may vary form 200°F to 350°F.

_____ 4. It is not necessary for the surfaces to be joined or bonded to fit together too well.

_____ 5. If the surfaces to be joined are not too clean, the flux will clean it well enough.

_____ 6. The flux, if left on the joint, will make the joint last longer.

_____ 7. You should make all joints to be soldered slightly larger than necessary so more solder can be applied to the joint.

_____ 8. It is not possible to flow enough solder into the joint to completely stop up the pipe.

_____ 9. In all very high temperatures (300°F to 350°F) and very low temperatures (-20°F to -50°F), soft solder (50-50 or 95-5) should not be used.

_____ 10. The appearance of the joint is not important.

INSTRUCTOR'S FINAL CHECKLIST

USE SOFT SOLDER TO JOIN METAL

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In learning to soft solder, the student:	FULLY AC	NOT AC	NOT AP
1. Wore safety glasses.			
2. Removed burrs and fittings.			
3. Cleaned tubing and fittings.			
4. Partially assembled tubing to fittings.			
5. Applied flux to tubing.			
6. Heated tubing and fitting until solder flowed into the joint.			
7. Tested the joint for leaks.			
8. Cleaned the joint.			
9. Cleaned work area and stored materials.			

Appliance Repairer

LEVEL APPLIANCE CABINETS

INTRODUCTION

As an appliance installer and service technician you will need to level new units when installing them or after moving existing units. Appliances must be level for proper operating and draining. In this task assignment you will learn how to level appliance cabinets.

OBJECTIVE

Level a refrigerator cabinet to manufacturer's specifications. You will be rated according to the instructor's final checklist.

CHECK-OUT ACTIVITY

Given an unlevel refrigerator cabinet, a twelve inch level and hand tools, you must plumb cabinet. Upon completion, unit must operate and drain within manufacturer's specifications.

Learning Activities

1. READ Meyerink, G., Appliance Service Handbook, pages 42-44 and 54-55.

   (or) ______________________________

2. READ Instruction Sheet I, "Leveling Cabinets."

3. OBSERVE your instructor demonstrate leveling an appliance cabinet.

4. CHECK YOUR KNOWLEDGE by completing Student Self-Check I, "Leveling Cabinets."

5. PRACTICE leveling an appliance provided by the instructor. Follow the procedure in Instruction Sheet I.

6. COMPLETE the check-out activity listed for this task assignment. You will be rated according to the instructor's final checklist.

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Instruction Sheet I

LEVELING CABINETS

OBJECTIVE: Leveling Cabinets

MATERIALS:

12" level
unlevel cabinet
rule
wrench

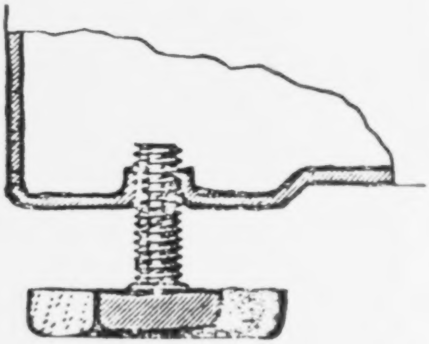
PROCEDURE:

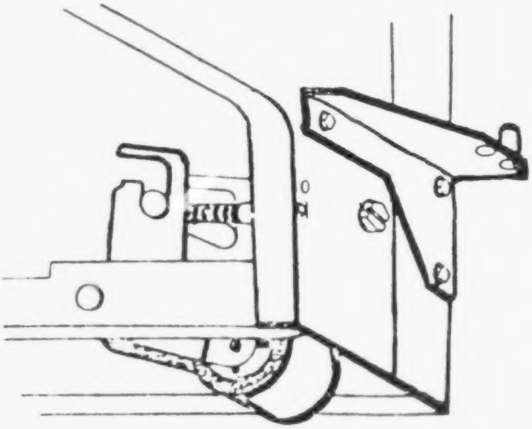
1. Using the level, check the floor to make sure it is reasonably level at the back of the cabinet.

2. If the floor is not level at the back of the cabinet, measure the amount it is out of level; use a wood shim to raise the cabinet.

3. After you have placed the wood shim, check again for levelness. If it is level, you may proceed. If it is not level, get a larger shim.

4. After the back is leveled, check the front for levelness. If is not level, use the wrench to move the adjusters either in or out to make the cabinet level.





5. Lengthening the bolt will raise that side of the cabinet while shortening it will lower that side of the cabinet.

6. Recheck level.

Instruction Sheet I (page 2)

7. If the top of the cabinet is level, the sides should be plumb.

8. Check drainage by pouring a small cup of water into the evaporator area. It should drain out.

Student Self-Check I

LEVELING CABINETS

On a separate sheet of paper answer the following questions.

1. Why must a refrigerator cabinet be level?
2. Why must the floor be checked before attempting to level the cabinet?
3. What is used to check the level of a cabinet?
4. What is used to level a refrigerator cabinet?
5. What directions on the cabinet are checked for levelness and plumbness?

INSTRUCTOR'S FINAL CHECKLIST

LEVEL APPLIANCE CABINET

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In learning to level cabinets, the students:

	FULLY AC	NOT AC	NOT AP
1. Used the proper tools.	____	____	____
2. Leveled the cabinet.	____	____	____
3. Plumbed the cabinet.	____	____	____
4. Checked drainage of the cabinet.	____	____	____
5. Performed all tasks in a safe manner.	____	____	____

Appliance Repairer

ADJUST DOORS ON REFRIGERATORS AND FREEZERS

INTRODUCTION

As an appliance repair technician, you will have numerous occasions to adjust the doors on refrigerators and freezers. To operate efficiently, the door must close properly and form an airtight seal. In this task assignment, you will learn to adjust the doors on refrigerators and freezers to properly attain this seal.

OBJECTIVE

Your instructor will provide a refrigerator or freezer cabinet with a maladjusted door and the necessary tools and equipment. Adjust the cabinet door to the manufacturer's specifications. You will be rated according to the instructor's final checklist.

CHECK-OUT ACTIVITY

Given a refrigerator or freezer cabinet with a maladjusted door and necessary equipment and supplies, adjust the cabinet door. Door must conform to specifications of paper method, 100 watt lamp method, and closing and opening at 25 second interval method upon completion of task.

Learning Activities

1. READ Instruction Sheet I, "Adjusting Doors on Refrigerator and Freezers."
2. OBSERVE your instructor demonstrate adjusting a refrigerator or freezer door and the methods used to test for proper seal.
3. CHECK YOUR KNOWLEDGE by completing Student Self-Check I, "Adjusting Doors on Refrigerators and Freezers."
4. PRACTICE Making adjustiments on cabinet doors using equipment provided by your instructor. Use Instruction Sheet I as a guide.
5. COMPLETE the check-out activity listed for this task assignment. You will be rated according to the instructor's final checklist.

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Instruction Sheet I

ADJUSTING DOORS ON REFRIGERATORS AND FREEZERS

MATERIALS:

Phillips screwdriver
Nut driver set
Shim material
Piece of paper

PROCEDURE:

1. Observe maladjusted door to determine the direction in which it is out of alignment.
2. Examine the adjustment mechanism to determine the type of movement involved.
3. If the door is down, loosen the screws at the top hinge; lift the door until it is level with the top of the cabinet and re-tighten the screws.
4. Check for proper operation and tight closure by placing a sheet of paper between the door and jamb. Pull on paper. It should be tight.
5. If the door gasket rubs at the rear near the hinge, place a shim behind the hinge and make the door move out and relieve the rubbing condition. Different combinations of shims may be required.
6. Check proper operation again by the paper method.

Student Self Check I

ADJUSTING DOORS ON REFRIGERATORS AND FREEZERS

Answer the following questions.

1. Why is a proper door fit important?
2. In what direction are doors usually adjusted.
3. What are the shims used for?
4. How is door alignment checked?
5. How is door tightness checked?

INSTRUCTOR'S FINAL CHECKLIST

ADJUSTING DOORS ON REFRIGERATORS AND FREEZERS

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

	FULLY AC	NOT AC	NOT AP
In learning how to adjust doors on refrigerator and freezers, the student:			
1. Selected the proper tools.			
2. Adjusted door to instructor's specifications.			
3. Check alignment.			
4. Checked tightness.			
5. Performed all tasks in a safe manner.			

Appliance Repairer

INSTALL ICE MAKER

INTRODUCTION

The automatic ice maker has become one of the most widely accepted appliance accessories. Many refrigerators are designed so that an ice maker is readily installed by the serviceman. In this task assignment you will learn to install an automatic ice maker.

OBJECTIVE

Using tools and equipment provided by the instructor, you will install an ice maker in the freezer compartment of a refrigerator. You will be evaluated according to the instructor's final checklist.

CHECK-OUT ACTIVITY

Given an ice maker, an installation kit, and the necessary tools, install the ice maker in a refrigerator so that it does not leak and tubing is inconspicuous.

Learning Activities

1. READ the material in Refrigeration II, Whirlpool Corporation, pages 49-71.

   (or) ______________________________

2. VIEW the filmstrip "Understanding And Servicing the Compact Ice Maker," Whirlpool Corporation.

3. OBSERVE a demonstration by the instructor on the installation of an ice maker in a refrigerator.

4. CHECK YOUR KNOWLEDGE on a separate sheet of paper, complete the unit test for Lesson 3, Refrigeration II, Whirlpool Corporation. Have your instructor check your answers.

5. PRACTICE installing an ice maker using tools and equipment furnished by the instructor.

6. COMPLETE the check-out activity listed for this task assignment. You will be evaluated according to the instructor's final checklist.

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INSTRUCTOR'S FINAL CHECKLIST

INSTALL ICE MAKER

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

The student performed the following in installing an ice maker:

	FULLY AC	NOT AC	NOT AP
1. Identified location for ice maker to be installed.	____	____	____
2. Turned off water supply.	____	____	____
3. Measured and cut tubing to length for installation.	____	____	____
4. Ran tubing from refrigerator to water line.	____	____	____
5. Connected tubing to properly installed saddle valve.	____	____	____
6. Mounted ice maker in refrigerator.	____	____	____
7. Tightened all connections.	____	____	____
8. Turned on water supply and saddle valve, observed for leaks.	____	____	____
9. Checked operation of ice maker.	____	____	____
10. Cleaned work area.	____	____	____

Appliance Repairer

REPAIR FLEX TRAY ICE MAKER

INTRODUCTION

The Flex Tray Ice Maker is one of the newer developments in automatic ice makers. This component serves a dual function. It controls the freezer defrost cycle in addition to making ice.

OBJECTIVE

Given a Flex Tray Ice Maker and the necessary tools by the instructor, you will learn how the Flex Tray Ice Maker operates and how to disassemble, identify parts, reassemble and check for proper operation. You will be evaluated according to the instructor's final checklist.

CHECK-OUT ACTIVITY

You will troubleshoot, disassemble, and reassemble a Flex Tray Ice Maker. System must operate within manufacturer's specifications with no leaks upon completion of task.

Learning Activities

1. READ "The New Flex-Tray Ice Maker, " Whirlpool Corporation.

   (or) ______________________________

2. VIEW filmstrip, "The New Flex-Tray Ice Maker," Whirlpool Corporation.

   (or) ______________________________

3. OBSERVE a lecture/demonstration by the instructor on disassembling and troubleshooting a Flex-Tray ice maker.

4. CHECK YOUR KNOWLEDGE by completing Student Self-Check I. Have the instructor check your answers.

5. PRACTICE troubleshooting a Flex-Tray Ice Maker.

6. COMPLETE the check-out activities listed for this task assignment. You will be evaluated according to the instructor's final checklist.

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Student Self-Check I

REPAIR FLEX-TRAY ICE MAKER

On a separate sheet of paper, answer the following:

1. The timing mechanism of the Flex-Tray automatic ice maker:
   - A. times the ice ejection cycles.
   - B. times the defrosting cycles.
   - C. controls the thermostat and compressor circuits.
   - D. controls all circuits except the lights on some models and the stile heaters on others.
   - E. all of the above.
2. How many electrical components does the Flex-Tray assembly have?
   - A. Two
   - B. Three
   - C. Four
   - D. Five
3. The ice ejection timing gear, drive gear, and cam locking drive pin will align themselves and start an ejection cycle every:
   - A. two hours.
   - B. two hours of timer motor "run" time.
   - C. 13-1/3 minutes.
4. When the ice ejection components are reinstalled, and the gear alignment holes and the pilot holes are not properly lined up, the ice maker will never eject ice.

   A. ___ TRUE B. ___ FALSE
5. The defrost gear train is driven by the:
   - A. large pinion gear of the motor.
   - B. small pinion gear of the motor.
6. The defrost switch is actuated by:
   - A. the ratchet cam.
   - B. the ejector cam.
   - C. the cam follower lever.
   - D. the cam and pinion gear.

Student Self-Check I (page 2)

7. When reassembled after service and all the defrost gear train assembly components are installed correctly, a defrost cycle will automatically take place:

   A. after 6.9 hours of "on" time.
   B. immediately.
   C. after 9.6 hours of compressor running time.

8. There are not adjustable water fill components in the Flex Tray assembly.

   A. ____ TRUE B. ____ FALSE

9. What happens if you disconnect the ice maker and take it into the shop for service and return it 3 days later?

   ____

   ____

10. What happens when you reinstall the ice maker if you have been servicing the product with the freezer door open long enough for the freezer to warm to room temperature.

   ____

   ____

INSTRUCTOR'S FINAL CHECKLIST

REPAIR FLEX-TRAY ICE MAKER

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

The student performed the following task activities:

	FULLY AC	NOT AC	NOT AP
1. Diassembled the Flex-Tray Icemaker.			
2. Identified the parts of the Flex Tray Icemaker motor, defrost switch, water switch.			
3. Described how the Icemaker works.			
4. Reassembled the Flex Tray Icemaker.			
5. Checked for proper operation.			
6. Performed all activities in a safe manner.			
7. Took test Refrigeration II, Lesson 4.			

Appliance Repairer

REPLACE REFRIGERATOR DEFROSTER HEATING ELEMENT

INTRODUCTION

Automatic defrost model refrigerators have one or more heaters to melt the frost that has accumulated on the evaporator during compressor running cycle. Failure of the heater can cause improper cooling and/or failure of the unit to defrost.

OBJECTIVE

Using materials provided by the instructor, you will replace a refrigerator defrost heater. You will be evaluated according to the instructor's final checklist.

CHECK-OUT ACTIVITY

Your instructor will provide you with an automatic defrost refrigerator, a replacement defrost heater, and the proper tools to replace the heater. You will install the heater and insure that the refrigerator operates at manufacturer's specifications.

Learning Activities

1. READ Manufacturer Repair Manual.
2. OBSERVE instructor demonstration of how to replace defroster heater on an automatic defrost refrigerator.
3. PRACTICE replacing a defrost heater in an automatic defrost refrigerator.
4. COMPLETE the check-out activity listed for this task assignment. You will be rated according to the instructor's final checklist.

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INSTRUCTION SHEET I

REPLACE REFRIGERATOR DEFROSTER HEATING ELEMENT

1. Disconnect power supply.
2. Remove evaporator cover to gain access to defrost heater.
3. Remove heater and install replacement.
4. Reassemble refrigerator and reconnect power supply.
5. Clean up area and store tools and materials.

INSTRUCTOR'S FINAL CHECKLIST

REPLACE REFRIGERATOR DEFROSTER HEATING ELEMENT

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In replacing the refrigerator defroster heating element, the student performed the following:

	FULLY AC	NOT AC	NOT AP
1. Disconnected power supply.	____	____	____
2. Removed heater and installed replacement.	____	____	____
3. Reassembled refrigerator and reconnected power supply.	____	____	____
4. Cleaned up area and stored tools.	____	____	____

Appliance Repairer

SERVICE ELECTRIC MOTORS

INTRODUCTION

In servicing home appliance equipment, it is often necessary to service electric motors. The motor is used to turn power, pumps, and external drive compressors. In performing preventive maintenance, you must be able to service all types of electric motors to insure proper operation of equipment. In this task assignment, you will learn how to correctly service these motors.

OBJECTIVE

Your instructor will provide you with a volt-ohmmeter, ammeter, and other necessary equipment and supplies. The instructor will provide a performance guide for servicing an electric motor. You must then service the motor provided.

CHECK-OUT ACTIVITY

Given a motor, a volt-ohmmeter, an ampere meter and other necessary equipment and supplies, service the motor according to preventive maintenance specifications.

Learning Activities

1. READ Meyerink, G., (1973), Appliance Service Handbook, pages 88-93.

   (or) ______________________________

2. OBSERVE your instructor demonstrate the procedures to use in servicing electric motors.

3. READ Instruction Sheet I, "Servicing Electric Motors."

4. PRACTICE servicing an electric motor using the procedures in Instruction Sheet I.

5. CHECK YOUR KNOWLEDGE of servicing electric motors by completing Student Self-Check I, "Servicing Electric Motors."

6. COMPLETE the check-out activities listed for this task assignment. Your performance will be rated according to the instructor's final checklist.

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INSTRUCTION SHEET I

SERVICING ELECTRIC MOTORS

WARNING: SOME ELECTRIC MOTORS HAVE CAPACITORS THAT CAN PRODUCE A FATAL ELECTRIC SHOCK. IF THE MOTOR YOU ARE WORKING ON HAS A CAPACITOR, BE SURE TO DISCHARGE THE CAPACITOR. IF YOU DO NOT REMEMBER HOW, REVIEW TASK ASSIGNMENT 8 FOR THE PROPER PROCEDURE.

There are several types of electric motors. The power that drives these motors differ. A motor will operate satisfactorily if maintained properly. Here are some points to remember.

1. The power must be turned off to a motor before any covers or belts are removed to avoid possible accidents. (A motor may develop a short when removing the cover of the motor electrical junction box.)

2. If is often necessary to replace or check belts. Belts will often become loose due to wear. However, it is not always necessary to replace the belt. To adjust the belt, loosen the jamb nut, adjust the belt tension screw, and retighten the jamb nut. (This applies more tension on the belt.) There are special tools called a belt adjusting and aligning tools which will help adjust belts. To overtighten a belt will cause sleeves to wear excessively or cause bearings in belt ends of the motor to overheat. One or more belts may be required in some instances depending on the load a motor must turn. The proper alignment of both motor pulley and machine pulley is essential. Improper alignment will cause excessive belt wear as well as excessive wear to the pulley. Whenever possible, the installation should be arranged so that the belt pulls on on the bottom side of the pulley. Pulleys come in a wide variety of sizes and designs. Some pulleys have a fixed setting while others may be adjusted by loosening the flange with a Allen wrench and adjusting it either in or out. When the pulley is adjusted inward, the speed of the driven machine (or compressor) is increased; when the pulley is adjusted outward, the speed will be decreased. The amperage on a belt driven motor will increase or decrease as the setting of the adjustable pulley is changed. The set screw that holds the pulley to the motor shaft will often become loose due to pressure or vibration while the motor is in operation. In such event, the pulley must be realigned and tightened.

3. When removing the capacitor from a permanent split capacitor motor, the capacitor must be discharge by using a resistor, capacitor analyzer, or volt-ohmmeter before it can be handled. The capacitor will hold a charge which can cause a severe electrical shock unless it is discharged properly.

INSTRUCTION SHEET I (page 2)

The purpose for removing the capacitor is to visually inspect it for possible pin holes, cracks, oil leakage, shorts, or open circuits and to determine whether the capacitor has changed value.

4. Removing a motor and cleaning any air passages will prolong its life. Dirt will accumulate around any openings due to air passing through the motor. To clean the motor properly, it should be brushed clean or cleaned by using a vacuum cleaner. If air pressure is available, this also may be used. If the motor is excessively dirty, it may be necessary to disassemble the motor and clean the various motor components.

5. The motor should also be checked for a bent shaft and for end play. A bent shaft will cause the motor to vibrate; it will also cause excessive wear on sleeves and bearings, and overheating. End play also causes the pulley to run out of alignment which results in excessive wear on pulleys and belts.

6. A motor should turn free when the belt is removed. If the motor does not turn freely, the sleeves or bearings may be worn or the motor may need to be lubricated. When it is necessary to lubricate a motor that uses the wick lubrication system, the oil well should be filled by adding the amount of SAE 20 oil designated or until oil appears in the lower oil level cup. On a slip ring system, one or two drops of SAE 30 oil every six months is sufficient. Motors that have ball bearings must be lubricated with a small amount of bearing grease every two or three months. Over-greasing or excessively oiling a motor can cause internal motor problems.

7. To check the amperage, connect the ampmeter according to Figure 1. Check the readings to see if they match the data plate on the motor.

STUDENT SELF-CHECK I

SERVICING ELECTRIC MOTORS

On a separate sheet of paper, write the correct answers to the following questions.

1. What must be done before belts or covers are removed?
2. An over-tightened belt will cause the ___________ to overheat.
3. Pulleys may either be __________ or ____________ depending on their purpose.
4. Size and adjustment of pulleys will affect _____________ of motor.
5. The capacitor will hold a charge unless it is ______________________.
6. Some motors use ___________ for lubrication, while others use__________.

INSTRUCTOR'S FINAL CHECKLIST

SERVICE ELECTRIC MOTORS

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

While servicing an electric motor, the student:	FULLY AC	NOT AC	NOT AP
1. Selected the proper tools.			
2. Disconnected power.			
3. Removed belt.			
4. Discharged capacitor (if it is a capacitor motor).			
5. Cleaned motor with brush and vacuum cleaner or air pressure.			
6. Checked motor shaft for up and down movement and end play.			
7. Checked for free spin.			
8. Lubricated motor and checked for cleanliness loose set screw and pulley alignment.			
9. Checked and recorded information on motor data plate.			
10. Replaced belt.			
11. Operated motor and checked voltage and amps.			
12. Performed all tasks in a safe manner.			

Appliance Repairer

INSTALL ELECTRIC RANGE

INTRODUCTION

Proper installation of an electric range is required for the user to receive the value for which the appliance was purchased. This task assignment will help you to learn about range installation.

OBJECTIVE

Given an electric range, electrical tools and materials by the instructor, you will install an electric range according to the manufacturer's specifications. You will be evaluated according to the instructor's final checklist.

CHECK-OUT ACTIVITY

Install an electric range and check range under normal load conditions for correct operation. When installed, indicator lights will illuminate, heating elements heat in various "on" positions and cease to heat when turned off.

Learning Activities

1. READ Whirpool Corporation, Electric Range.

   (or) ____

2. READ range manufacturer's installation instruction sheet for range to be installed.

   (or) ____

3. OBSERVE a demonstration by the instructor on the procedures to be used when installing an electric range.

4. PRACTICE installing an electric range. Follow manufacturer's instruction sheet.

5. COMPLETE the checkout activity listed for this task assignment. You will be rated according to the instructor's final checklist.

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INSTRUCTOR'S FINAL CHECKLIST

INSTALL ELECTRIC RANGE

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In installing an electric range the student performed the following:

	FULLY AC	NOT AC	NOT AP
1. Gathered necessary tools for installing electric range.	___	___	___
2. Uncrated the electric range.	___	___	___
3. Read manufacturer's installation instructions.	___	___	___
4. Installed the electric range and leveled.	___	___	___
5. Checked range for proper operation.	___	___	___
6. Checked and stored all materials.	___	___	___

Appliance Repairer

REPLACE A SURFACE UNIT ON AN ELECTRIC RANGE

INTRODUCTION

The surface heating element of an electric range is of rugged design, heats and cools quickly, and withstands food and liquid spillage. Almost all heating elements are sealed units with a Nichrome resistance coil surrounded by an insulating material enclosed in stainless steel tubing.

OBJECTIVE

Given an electric range, test equipment, hand tools, and a replacement surface unit by the instructor, you will replace a defective surface unit on an electric range. You will be evaluated according to the instructor's final checklist.

CHECK-OUT ACTIVITY

You will replace a defective surface heating unit on an electric range with a new unit. The replacement will operate to the manufacturer's original specifications.

Learning Activities

1. READ Whirlpool Corporation, Range Service, pp. 24-26.

   (or) ____________________

2. OBSERVE the instructor demonstrate the procedures to be followed in replacing a surface heating unit.
3. PRACTICE replacing a surface unit on an electric range. Follow the steps outlined in Instruction Sheet 1.
4. COMPLETE the check-out activity listed for this task assignment. You will be rated according to the instructor's final checklist.

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INSTRUCTION SHEET I

REPLACE A SURFACE UNIT ON AN ELECTRIC RANGE

Disconnect power cord or fuses before starting.

1. Tilt the heating element upward on its hinge to a 45 degree angle and remove the Phillips head screw holding the unit to the range.
2. Lift the heating element up and out to expose the wiring.
3. Remove the snap clips or screws holding the insulating block to the element and remove the wires.
4. Attach the wires to the new unit, observing polarity.
5. Reinstall insulators.
6. Reattach the assembled unit to the range.
7. Place trim ring in position and lower unit to operating position.
8. Test unit for proper operation.

INSTRUCTOR'S FINAL CHECKLIST

REPLACE A SURFACE UNIT ON AN ELECTRIC RANGE

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.	FULLY AC	NOT AC	NOT AP
In replacing a range surface unit, the student performed the following:			
1. Gathered necessary tools and equipment.	____	____	____
2. Safely removed and replaced defective surface unit.	____	____	____
3. Tested unit for proper operation after repair.	____	____	____
4. Cleaned work area and stored materials in proper place.	____	____	____

Appliance Repairer

TROUBLESHOOT AN ELECTRIC RANGE

INTRODUCTION

The appliance repairer must be able to diagnose and repair malfunctions in an electric range. In this task assignment you will learn the procedures to follow in troubleshooting an electric range.

OBJECTIVE

Given a variety of problems that would affect the operation and performance of an electric range, you will discuss in writing the usual causes of the problem and the remedial action to take to repair the problem. You will be evaluated according to the instructor's final checklist.

CHECK-OUT ACTIVITY

You will answer, in writing, the usual cause of commonly reported problems of electric ranges. The action to repair the problem must be described for the problems listed in Student Self Check I.

Learning Activities

1. READ Whirlpool Corporation, Range Service, pp. 75-78.

   (or) ______________________________

2. OBSERVE the instructor demonstrate the procedures for troubleshooting the various parts of an electric range.

3. PRACTICE discussing the problem areas of an electric range and the action to correct the problems.

4. COMPLETE the check-out activity listed for this task assignment. You will be evaluated according to the instructor's final checklist.

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STUDENT SELF CHECK I

TROUBLESHOOT AN ELECTRIC RANGE

To check your knowledge of troubleshooting an electric range, answer the following on a separate piece of paper.

For each of the following commonly reported problems, list the usual causes, the remedial action to be taken, and the tools and materials needed:

1. surface unit fails to heat
2. unit underheats
3. unit overheats
4. unit doesn't maintain steady heat
5. clock/timer inoperative
6. surface plug outlet is dead
7. oven too hot or too cold

You will complete this exercise in 45 minutes.

INSTRUCTOR'S FINAL CHECKLIST

TROUBLESHOOT AN ELECTRIC RANGE

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.	FULLY AC	NOT AC	NOT AP
In troubleshooting an electric range, the student performed the following:			
1. Read assigned material.	____	____	____
2. Completed Student Self Check I in allotted time.	____	____	____
3. Demonstrated ability to repair or replace defective parts on an electric range (if available).	____	____	____
4. Checked range for proper operation.	____	____	____

Appliance Repairer

REPLACE ELECTRIC RANGE BALLAST TRANSFORMER

INTRODUCTION

Most electric ranges are equipped with a built-in florescent lamp to illuminate the range work-top. An inoperative light may be caused by a defective ballast transformer.

OBJECTIVE

Given an electric range, test instruments, hand tools, and a replacement ballast by the instructor, you will remove the defective ballast transformer and install a replacement. You will be rated according to the instructor's final checklist.

CHECK-OUT ACTIVITY

You will remove a defective ballast transformer from an electric range and install a replacement to meet the manufacturer's specification.

Learning Activities

1. READ Whirlpool Corporation, Basic Electricity for Appliances, pp. 143-151.
2. OBSERVE your instructor demonstrate ballast transformer replacement procedure.
3. CHECK YOUR KNOWLEDGE by writing your answers on a separate sheet of paper for the unit test for Lesson 13, Basic Electricity for Appliances.
4. PRACTICE removing and installing a ballast transformer on an electric range.
5. COMPLETE the check-out activity listed for this task assignment. You will be evaluated according to the instructor's final checklist.

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INSTRUCTION SHEET I

REPLACE ELECTRIC RANGE BALLAST TRANSFORMER

1. Disconnect range from power source or remove fuses.
2. Remove back cover panel from the range.
3. Disconnect wiring from ballast transformer.
4. Remove transformer.
5. Replace new transformer into position.
6. Connect wiring to proper terminals.
7. Replace back cover.
8. Restore power.
9. Check for operation.
10. Clean work area.

INSTRUCTOR'S FINAL CHECKLIST

REPLACE ELECTRIC RANGE BALLAST TRANSFORMER

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In replacing a ballast transformer, the student performed the following:

	FULLY AC	NOT AC	NOT AP
1. Disconnected power source.	_____	_____	_____
2. Removed back cover from range.	_____	_____	_____
3. Removed defective ballast transformer.	_____	_____	_____
4. Installed correct replacement ballast transformer.	_____	_____	_____
5. Replaced back cover.	_____	_____	_____
6. Restored power.	_____	_____	_____
7. Checked for proper operation.	_____	_____	_____

Appliance Repairer

REPLACE AN ELECTRIC RANGE CLOCK/TIMER

INTRODUCTION

The timer in an appliance has sometimes been referred to as the "brain" of the appliance in that the timer controls the sequence of operation of the appliance. This task assignment will prepare you to replace clock/timer assemblies.

OBJECTIVE

The instructor will provide an electric range, test instruments, hand tools, a service manual, and a replacement timer. You will remove the timer from the range and replace it with a new timer. The timer function of the range must operate within the manufacturer's recommendations.

CHECK-OUT ACITVITY

Given a defective clock-timer and the necessary tools and equipment, replace the clock-timer with a new unit so that it operates within the manufacturer's specifications.

Learning Activities

1. READ Whirlpool Corporation, Range Service, pp. 30-31.

   (or) ____________________

2. OBSERVE your instructor demonstrate the procedures to follow in replacing a clock-timer mechanism.

3. PRACTICE replacing a range clock-timer using the steps outlined in Instruction Sheet I.

4. COMPLETE the checkout activity listed for this task assignment. You will be evaluated according to the instructor's final checklist.

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INSTRUCTION SHEET I

REPLACE AN ELECTRIC RANGE CLOCK-TIMER

1. Disconnect range power supply.
2. Remove the back cover from the range to gain access to clock-timer.
3. Remove timer control knobs.
4. Disconnect wiring from clock-timer.
5. Remove timer from range.
6. Install the new timer in the range.
7. Connect wiring to timer and replace control knobs.
8. Replace the back cover.
9. Test for proper clock-timer operation after connecting power to range.
10. Clean work area.

INSTRUCTOR'S FINAL CHECKLIST

REPLACE A ELECTRIC RANGE CLOCK-TIMER

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In replacing a clock-timer the student performed the following:

	FULLY AC	NOT AC	NOT AP
1. Disconnected power supply.			
2. Removed back cover from range.			
3. Removed control knobs from timer.			
4. Disconnected wiring from timer and removed timer.			
5. Mounted new timer in range.			
6. Reconnected wiring and replaced control knobs.			
7. Installed back cover.			
8. Restored power and checked timer operation.			
9. Cleaned work area.			

Appliance Repairer

REPLACE ELECTRIC RANGE OVEN THERMOSTAT

INTRODUCTION

A defective oven thermostat will prevent proper regulation of oven temperatures. In this task assignment, you will learn to replace a oven thermostat.

OBJECTIVE

Given an electric range needing an oven thermostat, you will use tools and equipment furnished by the instructor to replace the oven thermostat. You will be evaluated according to the instructor's final checklist.

CHECK-OUT ACTIVITY

You will replace the oven thermostat on an electric range to original specifications given a new thermostat, electrical repair hand tools, and materials.

Learning Activities

1. READ in Meyerink, Appliance Service Handbook, pp. 331-344.

   (or)____

2. READ Whirlpool Service Booklet, "Range," pp. 11-26, 27-39.

   (or)____

3. VIEW the filmstrip, "Whirlpool Range Service."

   (or)____

4. OBSERVE a demonstration by the instructor on how to replace an electric range oven thermostat.

5. CHECK-YOUR KNOWLEDGE on a separate piece of paper, answer the questions in Whirlpool Corporation Service Booklet, "Range," pp. 26-27.

6. PRACTICE replacing an electric range oven thermostat.

7. COMPLETE the check-out activities listed for this task assignment. You will be rated according to the instructor's final checklist.

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STUDENT SELF-CHECK I

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1. Describe the purpose of the oven thermostat.
2. Describe the effect of these parts on the appliance.
3. Obtain the necessary tools and materials to replace part.
4. Replace the oven thermostat.
5. Reassemble and test for proper operation.
6. Describe why the parts were replaced.
7. Clean and store all materials in their proper places.

The student will accomplish the preceding tasks accurately and safely within a length of time considered reasonable by the instructor.

Where verbal demonstrations are required, the student will express himself clearly and precisely.

INSTRUCTOR'S FINAL CHECKLIST

REPLACE ELECTRIC RANGE OVEN THERMOSTAT

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.	FULLY AC	NOT AC	NOT AP
1. Gathered necessary tools an equipment.			
2. Replaced the oven thermostat.			
3. Tested for proper operation.			
4. Described why part was replaced.			
5. Cleaned and stored all materials in proper place.			
6. Took test, Chapter 2 and 3, Range.			

Appliance Repairer

INSTALL GARBAGE DISPOSAL UNIT

INTRODUCTION

The majority of new homes are equipped with a garbage disposal unit during construction and disposals can be fitted to existing sink installations in most older homes. In this task assignments you will learn how to install a garbage disposal unit.

OBJECTIVE

Given a garbage disposal unit and the necessary tools and equipment by the instructor, you will install the disposal. The disposal must operate to the manufacturer's specifications. You will be rated according to the instructor's final checklist.

CHECK-OUT ACTIVITY

You will install a garbage disposal in a kitchen sink using materials and tools furnished by your instructor. The disposal must operate within the manufacturer's specifications with no water leaks in the plumbing connections.

Learning Activities

1. READ Meyerink, G., Appliance Service Handbook, pages 50-51.
2. OBSERVE your instructor demonstrate the installation of a garbage disposal unit.
3. CHECK YOUR KNOWLEDGE by answering on a separate sheet of paper questions 1, 2 and 3 in Appliance Service Handbook page 51. Have your instructor check your answers.
4. PRACTICE installing a garbage disposal unit using tools and equipment provided by the instructor.
5. COMPLETE the check-out activity listed for this task assignment. You will be rated according to the instructor's final checklist.

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INSTRUCTOR'S FINAL CHECKLIST

INSTALL GARBAGE DISPOSAL UNIT

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In learning to install a garbage disposal, unit the student performed the following:

	FULLY AC	NOT AC	NOT AP
1. Installed flange-mount in sink.	____	____	____
2. Mounted disposal unit on flange-mount.	____	____	____
3. Connected disposal outlet to sink drain trap.	____	____	____
4. Connected disposal to electric power supply.	____	____	____
5. Tested disposal for proper operation with no leaks.	____	____	____
6. Cleaned work area and stored tools and materials.	____	____	____

Appliance Repairer

INSTALL AN ELECTRIC AUTOMATIC CLOTHES DRYER

INTRODUCTION

This task assignment will aid you in learning to install an electric automatic clothes dryer.

OBJECTIVE

Given an electric automatic clothes dryer, electrical cable, and tools and materials by the instructor, you will install an electric automatic clothes dryer. You will be evaluated according to the instructor's final checklist.

CHECK-OUT ACTIVITY

The instructor will provide an electric automatic clothes dryer, tools and equipment. You will install the dryer to the manufacturer's specifications.

Learning Activities

1. READ Whirlpool Corporation, Delivery, Handling and Installation of Whirlpool Laundry Products.
2. READ the dryer manufacturer's installation instructions.
3. OBSERVE the instructor demonstrate how to install an electric automatic clothes dryer.
4. PRACTICE the installation of an electric automatic clothes dryer using Instruction Sheet I as a guide.
5. COMPLETE the checkout activity listed for this task assignment. You will be rated according to the instructor's final checklist.

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INSTRUCTION SHEET I

INSTALL AN ELECTRIC, AUTOMATIC CLOTHES DRYER

1. Remove shipping crate from dryer.
2. Remove shipping accessories and installation kit.
3. Read manufacturer's installation instruction.
4. Locate power supply to dryer.
5. Attach venting accessories.
6. Connect to power source (ensure that appliance is grounded).
7. Level appliance.
8. Perform operational checks.
9. Clean work area and store tools.

INSTRUCTOR'S FINAL CHECKLIST

INSTALL AN ELECTRIC, AUTOMATIC CLOTHES DRYER

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In installing an electric, automatic clothes dryer, the student performed the following:

	FULLY AC	NOT AC	NOT AP
1. Selected proper location to install dryer.			
2. Provided power source and outside vent.			
3. Uncrated dryer without damage.			
4. Read installation instructions.			
5. Installed unit with proper vent and electrical connections.			
6. Checked dryer for proper operation.			
7. Cleaned work area and stored tools.			

Appliance Repairer

READING WIRING DIGRAMS FOR ELECTRIC CLOTHES DRYERS

INTRODUCTION

Wiring diagrams can lead you through the paths current takes in the various electrical circuits that control the operation of an electric clothes dryer. This task assignment will give you the necessary information to enable you to diagnose problems in the electrical circuits of an electric clothes dryer.

OBJECTIVE

Using materials provided by the instructor, you will study wiring diagrams of an electric clothes dryer and diagnose problems in the electrical circuits. You will use symbols used in electrical diagrams. Troubleshooting should begin by a visual inspection and observing machine operation.

CHECK-OUT ACTIVITY

Your instructor will provide an electric clothes dryer and wiring diagrams. You will interpret the wiring diagram and compare it with the wiring circuits. You will complete the unit test on wiring diagrams with a score of 85% or higher.

Learning Activities

1. READ Whirlpool Corporation, Basic Electricity for Appliances, p. 23.

   (or) Meyerink, Appliance Service Handbook, pp. 269-270.

   (or) ____

2. OBSERVE the presentation by the instructor on wiring diagrams and symbols.
3. PRACTICE identifying symbols given in the wiring diagram Instruction Sheet I.
4. PRACTICE identifying and comparing a wiring diagram with the electrical circuit in an electric clothes dryer.
5. COMPLETE the check-out activity listed for this assignment. You will be rated according to the Instructor's Final Checklist.

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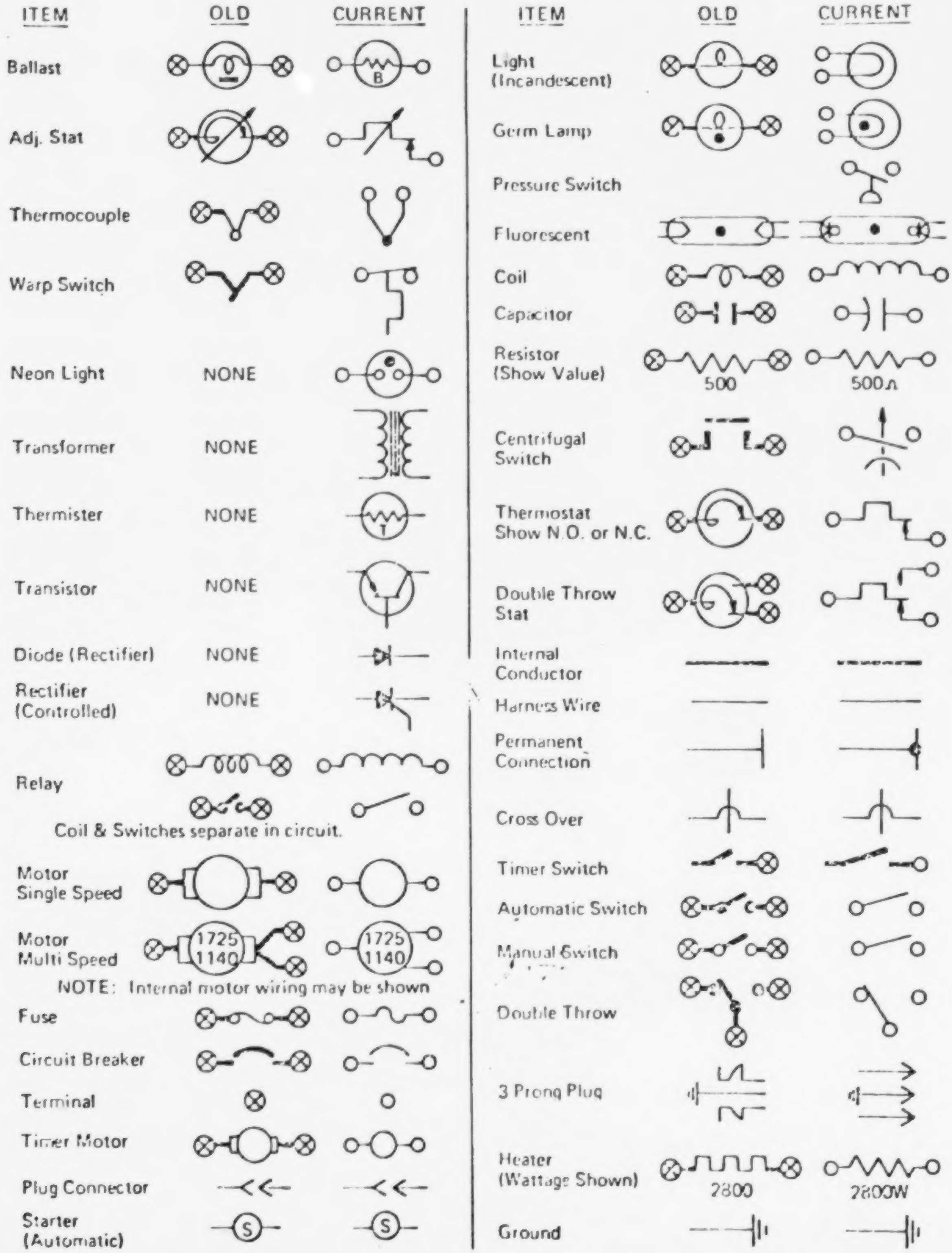
INSTRUCTION SHEET I

WIRING DIAGRAM SYMBOLS


ITEM
OLD
CURRENT
Ballast
B
Adj. Stat
Thermocouple
Warp Switch
Neon Light
NONE
Transformer
NONE
Thermister
NONE
T
Transistor
NONE
Diode (Rectifier)
NONE
Rectifier (Controlled)
NONE
Relay
Coil & Switches separate in circuit.
Motor Single Speed
Motor Multi Speed
1725
1140
NOTE: Internal motor wiring may be shown
Fuse
Circuit Breaker
Terminal
Timer Motor
Plug Connector
Starter (Automatic)
S
ITEM
OLD
CURRENT
Light (Incandescent)
Germ Lamp
Pressure Switch
Fluorescent
Coil
Capacitor
Resistor (Show Value)
500
500Ω
Centrifugal Switch
Thermostat Show N.O. or N.C.
Double Throw Stat
Internal Conductor
Harness Wire
Permanent Connection
Cross Over
Timer Switch
Automatic Switch
Manual Switch
Double Throw
3 Prong Plug
Heater (Wattage Shown)
2800
2800W
Ground

INSTRUCTOR'S FINAL CHECKLIST

READING WIRING DIAGRAMS FOR ELECTRIC CLOTHES DRYERS

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In applying electric clothes dryer wiring diagrams to electric circuits, the student performed the following:	FULLY AC	NOT AC	NOT AP
1. Read the material on wiring diagrams.	____	____	____
2. Identified wiring diagram symbols correctly.	____	____	____
3. Checked wiring diagrams against electrical circuits.	____	____	____
4. Completed unit test with score of 85% or higher.	____	____	____

Appliance Repairer

REPLACE ELECTRIC DRYER SERVICE CORD

INTRODUCTION

A defective service cord will not only affect dryer operation, but is a danger to people and property because of electrical shock or fire hazard.

OBJECTIVE

Given a clothes dryer, tools and replacement service cord by the instructor, you will replace the service cord to restore proper operation. You will be rated according to the instructor's final checklist.

CHECK-OUT ACTIVITY

The instructor will provide an electric clothes dryer, tools, a new service cord, and service manual. You will remove the old service cord and replace it with a new service cord. The dryer will operate to proper specifications.

Learning Activities

1. READ Whirlpool Corporation, Automatic Dryers, pp. 10-12

   (or)____

2. VIEW film, Whirlpool Corporation, "Delivery, Handling, and Installation of Whirlpool Laundry Products."
3. OBSERVE the instructor demonstrate service cord replacement.
4. PRACTICE replacing a dryer service cord.
5. COMPLETE the check-out activity listed for this task assignment. You will be rated according to the instructor's final checklist.

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INSTRUCTOR'S FINAL CHECKLIST

REPLACE ELECTRIC DRYER SERVICE CORD

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In replacing a service cord, the student performed the following:

	FULLY AC	NOT AC	NOT AP
1. Disconnected dryer from power supply.			
2. Examined service cord for damage.			
3. Selected proper replacement service cord.			
4. Removed and replaced service cord.			
5. Reconnected dryer and checked operations.			
6. Cleaned work area and stored tools.			

Appliance Repairer

REPLACE ELECTRIC DRYER HEATING ELEMENT

INTRODUCTION

The appliance repairer will encounter electric clothes dryers that will no longer heat. Heating elements are not repairable and must be replaced. In this task assignment, you will learn to replace a clothes dryer heating element.

OBJECTIVE

The instructor will provide an electric clothes dryer, test instruments, tools, and replacement heating element. You will remove a defective heating element and install a replacement so that the dryer operates at the manufacturer's specification. You will be rated according to the instructor's final checklist.

CHECK-OUT ACTIVITY

You will remove a defective heating element and install a replacement on an electric clothes dryer provided by your instructor.

Learning Activities

1. READ Whirlpool Corporation, Automatic Dryers, pp. 49-53.

   (or)______________________________

2. VIEW the film, "Service Procedures for Mechanical Systems," Whirlpool Corporation.

   (or)______________________________

3. OBSERVE the instructor demonstrate how to replace an electric clothes dryer heating element.
4. PRACTICE replacing an electric dryer heating element.
5. COMPLETE the check-out activity listed for this task assignment. You will be rated according to the instructor's final checklist.

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INSTRUCTION SHEET I

REPLACE ELECTRIC DRYER HEATING ELEMENT

1. Disconnect the dryer from the power supply.
2. Remove the back panel from the dryer.
3. Remove the heating element shield.
4. Disconnect the wires from the heating element.
5. Remove the heating element and install replacement.
6. Replace the heating element shield.
7. Connect the wiring to the heating element.
8. Replace back panel and reconnect power.
9. Check dryer operation.
10. Clean work area and store tools.

INSTRUCTOR'S FINAL CHECKLIST

REPLACE ELECTRIC DRYER HEATING ELEMENT

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In replacing an electric clothes dryer heating element, the student performed the following:

	FULLY AC	NOT AC	NOT AP
1. Disconnected power.			
2. Removed dryer back panel.			
3. Removed heating element shield.			
4. Removed and replaced heating element.			
5. Installed element shield and back panel.			
6. Tested dryer for proper operations.			
7. Cleaned work area and returned tools to storage			

Appliance Repairer

REPLACE ELECTRIC DRYER TEMPERATURE CONTROL

INTRODUCTION

Temperature regulation is one of the main requirements for proper clothes dryer operations. This task assignment will assist you in learning to replace temperature controls on an electric clothes dryer.

OBJECTIVE

You will remove and replace the temperature control on an electric clothes dryer using tools, test instruments, and replacement temperature control furnished by the instructor. You will be evaluated according to the instructor's final checklist.

CHECK-OUT ACTIVITY

Your instructor will provide you with a clothes dryer, a new temperature control, and tools. Install the new temperature control so that the dryer operates to manufacturer's specifications.

Learning Activities

1. READ Whirlpool Corporation, Automatic Dryers, pp. 99-105

   (or)______________________________

2. OBSERVE the instructor demonstrate replacing a dryer temperature control assembly.

3. PRACTICE replacing a temperature control assembly on an electric clothes dryer.

4. COMPLETE the check-out activity listed for this task assignment. You will be rated according to the instructor's final checklist.

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INSTRUCTION SHEET I

REPLACE ELECTRIC DRYER TEMPERATURE CONTROL

1. Disconnect power supply.
2. Remove the control panel back cover and the dryer back panel.
3. Remove the control knob and control mounting screws.
4. Remove the clamp which holds the capillary lines.
5. Remove the sensing tube from the brackets and disconnect electrical terminals.
6. Remove the temperature control unit and install the new unit, follow reverse order of the above steps.
7. Connect the power supply and test for proper operation.

INSTRUCTOR'S FINAL CHECKLIST

REPLACE ELECTRIC DRYER TEMPERATURE CONTROL

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In replacing a temperature control unit, the student performed the following:

	FULLY AC	NOT AC	NOT AP
1. Removed panels for access.			
2. Removed mounting fixtures.			
3. Removed sensing tube and electrical terminals.			
4. Installed new thermostat and control.			
5. Reassembled the unit.			
6. Connected power supply and checked operation.			

Appliance Repairer

REPLACE ELECTRIC DRYER DRIVE BELT

INTRODUCTION

The belt drives the drum through a pulley system attached to the motor shaft. Tension is maintained by use of a spring or torsion bar that is part of the idler pulley. The configUration and parts of the idler assembly vary in different dryers.

OBJECTIVE

Using material provided by the instructor, you will replace an electric clothes dryer belt. You will be evaluated according to the instructor's final checklist.

CHECK-OUT ACTIVITY

Your instructor will provide you with an electric clothes dryer, a replacement belt, and the proper tools to replace the belt. You will install the belt and insure that the dryer operates at manufacturer's specifications.

Learning Activities

1. READ Manufacturer's Repair Manual.

   (or) ______________________________

2. OBSERVE instructor's demonstaration of how to replace the belt on an electric clothes dryer.

3. PRACTICE replacing an electric clothes dryer drum belt.

4. COMPLETE the check-out activity listed for this task assignment. You will be rated according to the instructor's final checklist.

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INSTRUCTION SHEET I

REPLACE ELECTRIC DRYER DRIVE BELT

1. Disconnect power supply.
2. Remove cabinet panel(s) to gain access to belt and idler pulley mechanism.
3. Swing idler out to release tension or belt.
4. Remove belt.
5. Inspect idler pulley mechanism.
6. Install new belt.
7. Clean work area and store tools and materials.

INSTRUCTOR'S FINAL CHECKLIST

REPLACE ELECTRIC DRYER DRIVE BELT

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In replacing the electric clothes dryer belt, the student performed the following:

	FULLY AC	NOT AC	NOT AP
1. Disconnected power supply.			
2. Inspected belt for wear/damage.			
3. Removed old belt and installed new one.			
4. Reconnected power supply.			
5. Checked dryer operation.			
6. Cleaned work area and stored tools.			

Appliance Repairer

REPLACE DRYER MOTOR CAPACITOR

INTRODUCTION

The capacitor start motor is most often found in the larger appliances. The addition of a capacitor to the start winding allows its magnetic field to build to a peak sooner. This produces more starting torque with less input power.

OBJECTIVE

Given an automatic clothes dryer, test instruments, electrical hand tools, replacement capacitor, and service manual by the instructor, you will replace a defective motor capacitor. You will be rated according to the instructor's final checklist.

CHECK-OUT ACTIVITY

Provided a defective capacitor and the necessary tools, you will replace the capacitor so that all electrical connections are secure and the motor starts and runs quietly according to the manufacturer's specifications.

Learning Activities

1. READ Whirlpool Corporation, Automatic Dryers, pp. 38-46 and p. 131.

   (or)____

2. OBSERVE your instructor demonstrate how to replace the dryer motor capacitor.
3. PRACTICE replacing the dryer motor capacitor following the procedure outlined in Instruction Sheet I.
4. COMPLETE the check-out activity listed for this task assignment. You will be rated according to the instructor's final checklist.

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INSTRUCTION SHEET I

REPLACE DRYER MOTOR CAPACITOR

1. Disconnect power supply.
2. Remove the back panel from the dryer.
3. Remove the drive belts from the dryer.
4. Remove the capacitor cover from the motor and disconnect the wires from the capacitor (motor may have to be removed to reach capacitor).
5. Discharge capacitor.
6. Remove the capacitor and install replacement.
7. Reconnect wires to capacitor.
8. Replace the capacitor cover on the motor and secure the motor in the proper position.
9. Replace the drive belts and adjust tension.
10. Replace back panel on dryer.
11. Clean work area and return tools to storage.

INSTRUCTOR'S FINAL CHECKLIST

REPLACE DRYER MOTOR CAPACITOR

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In replacing a dryer motor capacitor, the student performed the following:

	FULLY AC	NOT AC	NOT AP
1. Determined capacitor replacement was required.			
2. Removed back cover, belts, and motor.			
3. Removed capacitor cover and wires.			
4. Discharged capacitor.			
5. Removed capacitor and installed replacement.			
6. Reconnected wiring and replaced cover.			
7. Replaced motor and drive belts.			
8. Installed back cover.			
9. Tested for proper operation.			
10. Cleaned work area and stored equipment.			

Appliance Repairer

REPLACE AN ELECTRIC DRYER BLOWER ASSEMBLY

INTRODUCTION

The blower assembly on a clothes dryer is responsible for maintaining a continuous air flow to the dryer drum while the dryer is in operation. This task assignment will aid you in replacing a dryer blower assembly.

OBJECTIVE

Given a clothes dryer with a defective blower assembly by the instructor, you will use the tools and service manual provided to remove and replace the blower assembly. You will be evaluated according to the instructor's final checklist.

CHECK-OUT ACTIVITY

Your instructor will provide an electric dryer and the necessary tools. You will replace the defective blower assembly to meet the manuafacturer's specifications.

Learning Activities

1. READ Whirlpool Corporation, Automatic Dryers, pp. 33-37.

   (or)____

2. OBSERVE your instructor demonstrate how to replace a blower assembly on an electric clothes dryer.
3. PRACTICE replacing a dryer blower assembly by following the procedure in Instruction Sheet 1.
4. COMPLETE the check-out activity for this task assignment. You will be rated according to the instructor's final checklist.

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INSTRUCTION SHEET I

REPLACE AN ELECTRIC DRYER BLOWER ASSEMBLY

1. Disconnect the dryer from the power supply.
2. Remove the back panel from the dryer to get to the blower assembly.
3. Remove the Allen-head screws attaching the motor to the blower.
4. Remove fasteners holding the blower assembly in place and remove blower assembly.
5. Install new blower assembly in correct position.
6. Test blower motor circuit for continuity.
7. Restore power and test dryer for proper operation.

INSTRUCTOR'S FINAL CHECKLIST

REPLACE AN ELECTRIC DRYER BLOWER ASSEMBLY

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In replacing a dryer blower assembly, the student performed the following:

	FULLY AC	NOT AC	NOT AP
1. Disconnected dryer from power supply.	_____	_____	_____
2. Removed back panel.	_____	_____	_____
3. Removed blower assembly from dryer.	_____	_____	_____
4. Installed new blower assembly.	_____	_____	_____
5. Restored power and tested dryer operation.	_____	_____	_____
6. Cleaned work area and stored all equipment.	_____	_____	_____

Appliance Repairer

TROUBLESHOOT AN ELECTRIC DRYER

INTRODUCTION

Troubleshooting an appliance is the diagnostic part of the appliance repairer's job. Once you have mastered the repair of the various parts of an electric dryer, it is necessary to apply what you have learned to an inoperative machine.

OBJECTIVE

Given various problems frequently found in automatic clothes dryers, you will diagnose the problem, explain the tools and action needed to correct the problem. You will be evaluated according to the instructor's final checklist.

CHECK-OUT ACTIVITY

Given a list of problems in an automatic clothes dryer, explain in writing the usual causes of the problems and the steps to correct the problems.

Learning Activities

1. READ Whirlpool Corporation, Automatic Dryers, pp. 141-143 and Whirlpool Corporation, Trouble Diagnosis and Service Procedures, pp. 32-34.

   (or)____

2. OBSERVE a demonstration by the instructor on troubleshooting an automatic clothes dryer.
3. PRACTICE using your knowledge of automatic clothes dryers to troubleshoot a clothes dryer.
4. COMPLETE the check-out activity listed for this task assignment. You will be rated according to the instructor's final checklist.

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INSTRUCTOR'S FINAL CHECKLIST

TROUBLESHOOT AN ELECTRIC DRYER

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In troubleshooting an automatic clothes dryer, the student performed the following:

	FULLY AC	NOT AC	NOT AP
1. Read assigned materials.			
2. Practiced troubleshooting dryers available in the shop.			
3. Completed writing Student Self-Check I.			

Appliance Repairer

INSTALL AN AUTOMATIC WASHER

INTRODUCTION

This task assignment will aid you in learning to install an automatic washer.

OBJECTIVE

Given an automatic washer, service manual, and tools by the instructor, you will properly install an electric washing machine. The machine will operate within the manufacturer's specifications with no leaks. You will be rated according to the instructor's final checklist.

CHECK-OUT ACTIVITY

You will install an automatic clothes washer. You will check for proper electrical supply, sufficient hot and cold water, and proper drain lines. The washer will operate within the manufacturer's specifications.

Learning Activities

1. READ Whirlpool Corporation, Understanding Automatic Washers, pp. 45-62.
2. VIEW the film "Delivery, Handling, and Installation of Whirlpool Laundry Products" by Whirlpool Corporation.

   (or)____
3. CHECK-YOUR KNOWLEDGE by answering on a separate sheet of paper Test 4, "Installation of An Electric Washing Machine," Understanding Automatic Washer.
4. PRACTICE installing an automatic washer. Use the procedures from Instruction Sheet I.
5. COMPLETE the check-out activity listed for this task assignment. You will be evaluated according to the instructor's final checklist.

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INSTRUCTION SHEET I

INSTALLING AN AUTOMATIC WASHER

1. Three requirements that must be met with every laundry installation are enough space, proper plumbing, and proper electrical supply.
2. The minimum width required for the 29 inch washer is 31 inches.
3. Make sure washer is level.
4. Proper plumbing means an adequate water supply and drainage system.
5. Water pressure must be between 10 and 100 psi.
6. Use a "Y" hose to check the dynamic pressure.
7. The point where the washer drain hose discharges water from the washer must be at least 34 inches and not more than 72 inches from the base of the washer.
8. The proper electrical supply is 120-volt, 60 hertz ac, 15-ampere time delay separately fused circuit with a three-prong grounded receptacle.
9. Never lay the washer on its side.
10. Make sure the customer has been instructed how to operate the washer.

INSTRUCTOR'S FINAL CHECKLIST

INSTALL AN AUTOMATIC WASHER

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.	FULLY AC	NOT AC	NOT AP
In installing an automatic clothes washer the student performed the following:			
1. Checked proper space, plumbing, and electrical source.	____	____	____
2. Leveled washer.	____	____	____
3. Checked water supply and drainage.	____	____	____
4. Checked water pressure.	____	____	____
5. Explained operating procedures for washer.	____	____	____
6. Cleaned work area and stored tools.	____	____	____

Appliance Repairer

REPLACE AUTOMATIC WASHER DRIVE BELT

INTRODUCTION

In an automatic washer, the drive belt connects the clutch and the transmission. The belt drives the transmission, which powers the agitator and the spin basket. The tension on the drive belt may be adjusted and/or the belt replaced when operation of the machine indicates belt problems.

OBJECTIVE

Using materials provided by the instructor, you will replace an automatic clothes washer drive belt. You will be evaluated according to the insructor's final checklist.

CHECK-OUT ACTIVITY

Your instructor will provide you with an automatic washer, proper tools, service manual, and a replacement drive belt. You will install the belt and insure that the washer operates at manufacturer's specifications.

Learning Activities

1. READ Manufacturer's Service Manual.

   (or) ______________________________

2. OBSERVE Instructor's demonstration of how to replace the drive belt on an automatic clothes washer.

3. PRACTICE replacing a drive belt on an automatic clothes washer.

4. COMPLETE the check-out activity listed for this task assignment. You will be rated according to the instructor's final checklist.

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INSTRUCTION SHEET I

REPLACE AUTOMATIC WASHER DRIVE BELT

1. Disconnect power and water supply.
2. Remove cabinet panel(s) to gain access to drive belt.
3. Loosen motor mounting bolts.
4. Remove old belt and install new one.
5. With hand leverage only, slide motor in mounting slots to tighten belt; tighten mounting bolts.
6. Check for 1/2" deflection at mid point between pulleys (readjust if necessary).
7. Reassemble washer, re-connect power and water supply.
8. Clean work area and store tools and materials.

INSTRUCTOR'S FINAL CHECKLIST

REPLACE AUTOMATIC WASHER DRIVE BELT

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In replacing the automatic washer belt, the student performed the following:

	FULLY AC	NOT AC	NOT AP
1. Disconnected power & water supply.			
2. Inspected belt for wear/damage.			
3. Removed old belt and installed new one.			
4. Reconnected power and water supply.			
5. Check washer operation.			
6. Cleaned work area and stored tools and materials.			

Appliance Repairer

REPLACE AUTOMATIC WASHER INJECTOR NOZZLE

INTRODUCTION

The water injector nozzle directs the flow of water into the washer basket. In this task asignment you will learn to replace a injector nozzle to meet original service specifications .

OBJECTIVE

Given an automatic washer, test instruments, proper tools, and a replacement water nozzle, you will replace the water injection nozzle. The washer must operate within the manufacturer's specifications with no leaks. You will be evaluated according to the instructor's final checklist.

CHECK-OUT ACTIVITY

You will replace a defective water injection nozzle on an automatic washer using tools and equipment, parts and a washer provided by the instructor. The washer will function to original specifications with no leaks.

Learning Activities

1. READ Whirlpool Corporation, Understanding Automatic Washers, pages 87-100.

2. VIEW film by Whirlpool, "Servicing Mechanical and Water Systems Above the Baseplate,"

   (or)____

3. OBSERVE the instructor demonstrate replacing an injector nozzle.

4. CHECK-YOUR KNOWLEDGE by answering the questions in Understanding Automatic Washers, page 100 on a separate sheet of paper. Check your answers with your instructor.

5. PRACTICE replacing an injector nozzle on an automatic washer. Follow the procedure outlines in Instruction Sheet I.

6. COMPLETE the check-out activity listed for this task assignment. You will be rated according to the instructor's final checklist.

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INSTRUCTION SHEET I

REPLACE AUTOMATIC WASHER INJECTOR NOZZLE

1. Disconnect power supply.
2. Remove the cabinet top.
3. Disconnect the filler base from the injection nozzle.
4. Observe the nozzle mounting position.
5. Install the new nozzle, using water-proof cement to hold the nozzle in place and to prevent leaks.
6. Attach the filler hose to the nozzle.
7. Align the nozzle and the hose to prevent splash-back.
8. Replace the cabinet top.
9. Reconnect power supply.
10. Clean work area and return tools to storage.

INSTRUCTOR'S FINAL CHECKLIST

REPLACE AUTOMATIC WASHER INJECTOR NOZZLE

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In replacing a washer injector nozzle the student performed the following:

	FULLY AC	NOT AC	NOT AP
1. Disconnected power supply.			
2. Removed panel for access to injector nozzle.			
3. Disconnected filler hose from nozzle.			
4. Installed replacement nozzle in same mounting position.			
5. Reconnected filler hose and aligned nozzle to prevent splashing.			
6. Replaced panel.			
7. Reconnected power supply.			
8. Tested washer for leaks.			
9. Cleaned work area and stored tools.			

Appliance Repairer

REPLACE AN AUTOMATIC WASHER TRANSMISSION

INTRODUCTION

In this task assignment, you will learn to replace the transmission in an automatic washer.

OBJECTVE

Given an automatic washer, proper tools, a replacement transmission, an a service manual - you will remove a defective automatic washer transmission and install a replacement. You will be rated according to the instructor's final checklist.

CHECK-OUT ACTIVITY

Your instructor will provide an automatic washer, proper tools, and a replacement transmission. You will install the replacement transmission so that the washer functions to original specifications.

Learning Activities

1. READ Whirlpool Corporation, Understanding Automatic Washers, Chapter 7.

   (or)____

2. VIEW the filmstrip, "Servicing Washer Mechanical And Water Systems Below the Baseplate," Whirlpool Corporation.

   (or)____

3. OBSERVE a demonstration by the instructor on replacing an automatic washer transmission.

4. CHECK YOUR KNOWLEDGE by answering on a separate sheet of paper the questions at the end of Chapter 7, Understanding Automatic Washers Have your instructor check your answers.

5. PRACTICE removing and replacing an automatic washer transmission. Follow the procedures in Instruction Sheet I.

6. COMPLETE the check-out activity listed for this task assignment. You will be rated according to the instructor's final checklist.

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INSTRUCTION SHEET I

REPLACE AN AUTOMTIC WASHER TRANSMISSION

1. Disconnect washer from power supply and water supply.
2. Remove the cabinet top and agitator from the washer.
3. Remove the water injector nozzle, washer tub, and the timer.
4. Remove the center boot seal, the cross braces, and the snubber.
5. Remove the bolts holding the transmission and lift the transmission out of the washer.
6. Place the transmission in a level upright position to prevent oil leakage.
7. Check replacement transmission for proper oil level.
8. Place the transmission in position and reassemble in reverse order of preceding steps.
9. Connect washer to power and water hookups and test for proper operation.

INSTRUCTOR'S FINAL CHECKLIST

REPLACE AN AUTOMATIC WASHER TRANSMISSION

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.	FULLY AC	NOT AC	NOT AP
In replacing an automatic washer transmission the student performed the following:			
1. Disconnected power and water supplies.			
2. Removed washer parts to gain access to transmission.			
3. Removed defective transmission and installed replacement.			
4. Reassembled washer in correct sequence.			
5. Restored power and water connections and tested for proper operations.			
6. Cleaned work area and stored all materials.			

Appliance Repairer

REPLACE AUTOMATIC WASHER TEMPERATURES SWITCH

INTRODUCTION

The water temperature switch in an automatic washer must function properly to insure correct wash water temperature. In this task assignment, you will learn to replace a temperature switch.

OBJECTIVE

Given an automatic washer, test instruments, proper tools, and a replacement water temperature switch by the instructor, you will replace the defective water temperature switch in an automatic washer. You will be rated according to the instructor's final checklist.

CHECK-OUT ACTIVITY

The instructor will provide an automatic washer, hand tools, and a replacement water temperature switch. You will remove the defective water temperature switch and replace it with a new switch. The washer must operate within the manufacturer's specifications.

Learning Activities

1. READ Whirlpool Corporation, Understanding Automatic Washers, pp. 69-70.

   (or)____

2. VIEW the Whirlpool Corporation filmstrip, "Reading and Understanding Wiring Diagrams for Washers."
3. OBSERVE the instructor demonstrate the replacement of a washer temperature control switch.
4. PRACTICE replacing a water temperature control switch on an automatic washer. Use the procedure outlined in Instruction Sheet I.
5. COMPLETE the check-out activity listed for this task assignment. You will be rated according to the instructor's final checklist.

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INSTRUCTION SHEET I

REPLACE AUTOMATIC WASHER TEMPERATURE SWITCH

1. Disconnect washer from power supply.
2. Remove panel for access to water temperature switch.
3. Diagram wiring to switch to use in connecting new switch.
4. Disconnect wiring from switch.
5. Remove fastners holding switch in place and remove switch.
6. Place new switch in position to mount.
7. Secure fastners for new switch.
8. Connect wiring to switch (refer to diagram from #3)
9. Connect washer to power source.
10. Test replacement switch on the different temperature settings.
11. Clean work area and return materials to storage.

INSTRUCTOR'S FINAL CHECKLIST

REPLACE AUTOMATIC WASHER TEMPERATURE SWITCH

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In replacing an automatic washer temperature switch the student performed the following:

	FULLY AC	NOT AC	NOT AP
1. Accessed switch and diagramed wiring.	______	______	______
2. Disconnected wiring from switch.	______	______	______
3. Removed old switch and installed replacement.	______	______	______
4. Connected washer to power supply and checked functioning of switch in all operating positions.	______	______	______
5. Cleaned work area and stored all materials.	______	______	______

TASK ASSIGNMENT SHEET APR-049

Appliance Repairer

REPLACE AUTOMATIC WASHER TIMER

INTRODUCTION

The timer function is important in many appliances. In the automatic washer it programs the cycles of the washer. This task assignment covers the replacing of a defective timer.

OBJECTIVE

Given an automatic washer, proper tools, and a replacement timer by your instructor, you will remove and replace the timer. If the unit is a repairable timer, you will replace parts that are defective. You will be rated according to the instructor's final checklist.

CHECK-OUT ACTIVITY

Your instructor will provide an automatic washer, replacement timer, and proper tools. You will remove and repair or replace the defective timer. The machine will function to the original specifications.

Kentucky Department of Education
Alice McDonald, Superintendent of Public Instruction
1984-85

Learning Activities

1. READ Whirlpool Corporation, Understanding Automatic Washers, pp. 63-69.

   (or) ______________________________

2. VIEW the filmstrip presentation by your instructor of "Understanding and Servicing Solid State Electronic-Controlled Whirlpool Washers," Whirlpool Corporation.

3. CHECK YOUR KNOWLEDGE by answering on a separate sheet of paper the questions in Student Self Check I.

4. PRACTICE installing a replacement timer in an automatic washer.

5. COMPLETE the check-out activity listed for this task assignment. You will be rated according to the instructor's final checklist.

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STUDENT SELF-CHECK I

REPLACE AUTOMATIC WASHER TIMER

1. Timer switches are given a snap action by the escapement to prevent:

   (A) over-riding
   (B) arcing
   (C) breaking
   (D) slipping

2. Water inlet valve circuits can be controlled by:

   (A) rotary or push-button switches
   (B) timer switch
   (C) auxiliary switch
   (D) all of the above
   (E) none of the above

3. The diaphragm in a water level pressure switch is directly actuated by:

   (A) air pressure
   (B) water weight
   (C) air weight
   (D) all of the above

4. The agitation solenoid and cam bar controls the ______________ function(s).

   (A) spinning
   (B) spinning and draining
   (C) agitiation and draining
   (D) agitation

5. Water level pressure switches are preset by the factory and do not need adjusting in the field.

   (A) True
   (B) False

6. When the lid is raised during the spin cycle, it will open the electrical circuit to the:

   (A) motor
   (B) motor and spin solenoid
   (C) spin solenoid
   (D) timer motor and spin solenoid

STUDENT SELF-CHECK I

Page 2

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7. The motor centrifugal switch de-energizes the __________ winding when the motor comes up to speed.

   (A) run
   (B) start
   (C) run and start
   (D) none of these

8. The three speed motor has:

   (A) 2 windings
   (B) 3 windings
   (C) 4 windings
   (D) 5 windings

9. On twenty-nine inch standard automatic washers, the high water level setting will allow the tub to fill to about:

   (A) 15 inches
   (B) 11 inches
   (C) 7 inches
   (D) 17 inches

10. Timers are constructed of three basic components. They are:

   (A) armature, stator, field
   (B) solenoid, cam switches, rotor
   (C) motor, escapement, cam switches
   (D) escapement, pinion, connecting rod

INSTRUCTOR'S FINAL CHECKLIST

REPLACE AUTOMATIC WASHER TIMER

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In replacing an automatic washer timer the student performed the following:

	FULLY AC	NOT AC	NOT AP
1. Tested washer functions.	____	____	____
2. Disconnected power supply.	____	____	____
3. Removed access panel.	____	____	____
4. Diagramed electrical connections.	____	____	____
5. Removed old timer.	____	____	____
6. Installed replacement or repaired old timer.	____	____	____
7. Reconnected power supply.	____	____	____
8. Checked washer for proper operations.	____	____	____
9. Cleaned work area and stored all materials.	____	____	____

Appliance Repairer

REPLACE AUTOMATIC WASHER PRESSURE SWITCH

INTRODUCTION

The pressure switch is a single pole double throw switch actuated by a diaphragm responding to pressure changes. This switch operates as the water-level control in dishwashers and automatic clothes washers. In this task assignment, you will learn to replace a pressure switch.

OBJECTIVE

Given an automatic washer, test instruments, tools, a replacement pressure switch, and a service manual by the instructor - you will remove a defective pressure switch and replace it with a new pressure switch. You will be rated according to the instructor's final checklist.

CHECK-OUT ACTIVITY

Your instructor will provide an automatic washer needing the pressure switch replaced, replacement parts, tools and materials. You will replace the pressure switch so that the washer operates within the manufacturer's specifications.

Learning Activities

1. READ Whirlpool Corporation, Understanding Automatic Washers, pp. 70-72.

   (or) ______________________________

2. VIEW a presentation by the instructor of the filmstrip, "Servicing Washer Mechanical and Water Systems Above the Baseplate" by Whirlpool Corporation.

3. OBSERVE the instructor demonstrate replacing a pressure switch.

4. PRACTICE replacing a pressure switch on an automatic washer. Follow the procedures outlined in Instruction Sheet I.

5. COMPLETE the check-out activity listed for this task assignment. You will be evaluated according to the instructor's final checklist.

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INSTRUCTION SHEET I

REPLACE AUTOMATIC WASHER PRESSURE SWITCH

1. Disconnect power supply.
2. Remove the cabinet top and panel necessary to get to the pressure switch.
3. Remove the wiring and hose connection from the switch.
4. Remove the fastners securing the switch to the cabinet.
5. Attach the new switch to the cabinet.
6. Replace the pressure hose, making sure that the hose clamp is tight.
7. Connect the washer to the power source and check for operation of switch.
8. Replace cabinet top and panel.
9. Check washer operation.
10. Clean work area and store all materials.

INSTRUCTOR'S FINAL CHECKLIST

REPLACE AUTOMATIC WASHER PRESSURE SWITCH

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In replacing an automatic washer pressure switch the student performed the following:	FULLY AC	NOT AC	NOT AP
1. Disconnected power source.	____	____	____
2. Removed panels for access to pressure switch.	____	____	____
3. Removed wiring and pressure hose from switch.	____	____	____
4. Installed new switch.	____	____	____
5. Reconnected wiring and hose.	____	____	____
6. Replaced panels.	____	____	____
7. Checked switch for proper operation.	____	____	____
8. Cleaned work area and stored tools and materials.	____	____	____

Appliance Repairer

REPLACE AUTOMATIC WASHER DRAIN PUMP

INTRODUCTION

An improperly operating drain pump will have to be repaired or replaced. This task assignment will help you in replacing and repairing washer drain pumps.

OBJECTIVE

The instructor will provide an automatic washer, proper tools, a replacement drain pump, and a service manual. You will remove a defective drain pump and install a replacement on the automatic washer. You will be evaluated according to the instructor's final checklist.

CHECK-OUT ACTIVITY

Your instructor will provide an automatic washer, tools, service manual, and a replacement drain pump. You will install the replacement drain pump so that the washer operates to the manufacturer's specifications.

Learning Activities

1. READ Whirlpool Corporation, Understanding Automatic Washers, pp 87-91.

   (or) ______________________________

2. VIEW the filmstrip presentation by the instructor of "Servicing Washer Mechanical and Water Systems Below the Baseplate."

3. CHECK YOUR KNOWLEDGE by answering on a separate sheet of paper questions 1, 4, 8, 9 in Understanding Automatic Washers, page 91. Have th instructor check your answers.

4. PRACTICE replacing and repairing an automatic washer drain pump. Follow the procedure outline in Instruction Sheet I.

5. COMPLETE the check-out activity listed for this task assignment. You will be rated according to the instructor's final checklist.

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INSTRUCTION SHEET I

REPLACE AUTOMATIC WASHER DRAIN PUMP

1. Disconnect washer from electric power supply and water supply.
2. Remove access panel(s) to gain access to drain pump.
3. Remove fastners holding pump in position after removing hose connections.
4. Remove drain pump from washer.
5. Remove the lower housing of the pump.
6. Inspect the impeller for damage.
7. Check the fit of the impeller on the shaft and replace if it cannot be fastened securely.
8. Test the shaft in the housing for excessive wear.
9. Inspect the seals and replace all damaged parts.
10. Reassemble the pump, and install if re-usable.
11. Install new drain pump if old pump is unrepairable.
12. Clean work area and store tools and materials.

INSTRUCTOR'S FINAL CHECKLIST

REPLACE AUTOMATIC WASHER DRAIN PUMP

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In replacing a washer drain pump the student performed the following:

	FULLY AC	NOT AC	NOT AP
1. Tested appliance to determine problem.	____	____	____
2. Removed drain pump.	____	____	____
3. Disassembled and inspected drain pump.	____	____	____
4. Repaired damaged pump if possible.	____	____	____
5. Reinstalled pump in washer.	____	____	____
6. Cleaned work area and stored tools.	____	____	____

Appliance Repairer

REPLACE AN AUTOMATIC WASHER ELECTRIC MOTOR

INTRODUCTION

The electric motor on an automatic washer is generally not rebuildable in the appliance repair shop. If an electric motor is defective, a replacement should be installed.

OBJECTIVE

Given an automatic washer, proper tools, a replacement electric motor, and a service manual by the instructor, you will replace a defective electric motor. You will be evaluated according to the instructor's final checklist.

CHECK-OUT ACTIVITY

Your instructor will provide you with an automatic washer, replacement electric motor, tools and supplies. You will replace the washer motor. On completion, the washer will operate within manufacturer's specifications with no leaks.

Learning Activities

1. READ Whirlpool Corporation, Understanding Automatic Washers, Chapter 5.
   (or) ______________________________
2. OBSERVE the instructor demonstrate the procedures to replace an automatic washer electric motor.
3. CHECK YOUR KNOWLEDGE by answering on a separate sheet of paper the questions at the end of Chapter 5, "Understanding Automatic Washers." Have the instructor check your answers.
4. PRACTICE replacing the electric motor on an automatic washer. Follow the procedure outlined in Instruction Sheet I.
5. COMPLETE the check-out activity listed for this task assignment. You will be rated according to the instructor's final checklist.

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INSTRUCTION SHEET I

REPLACE AN AUTOMATIC WASHER ELECTRIC MOTOR

1. Disconnect washer from power supply.
2. Remove panel to gain access to drive motor.
3. Remove the fasteners holding the motor in place.
4. Remove the drive belt from the motor pully.
5. Disconnect electrical wiring from the motor.
6. Remove the old motor.
7. Remove the pully from the old motor and install the replacement motor.
8. Connect electrical wiring to new motor.
9. Mount drive belt in motor pulley.
10. Align motor position and tighten mounting fasteners.
11. Install access panel.
12. Connect to power supply and check washer operation.
13. Clean work area and return tools to storage.

INSTRUCTOR'S FINAL CHECKLIST

REPLACE AN AUTOMATIC WASHER ELECTRIC MOTOR

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.	FULLY AC	NOT AC	NOT AP
In replacing an automatic washer electric motor the student performed the following:			
1. Disconnect power supply.	____	____	____
2. Loosened motor mounting.	____	____	____
3. Removed drive belt and electrical connections from motor.	____	____	____
4. Removed old motor and installed replacement.	____	____	____
5. Reinstalled belt and electrical connections.	____	____	____
6. Connected power supply and checked washer operation.	____	____	____

TASK ASSIGNMENT SHEET APR-053

Appliance Repairer

INSTALL AN ELECTRIC WATER HEATER

INTRODUCTION

There are many different kinds of hot water heaters in use, but the most common are the automatic storage type using either electrictity or gas. This task assignment deals with the installation of an electric water heater.

OBJECTIVE

Given an electric water heater and tools by the instructor, you will install an electric water heater. The system must operate to manufacturer's specifications with no leaks. You will be rated according to the instructor's final checklist.

CHECK-OUT ACTIVITY

Your instructor will provide you an electric water heater and tools. You will install the water heater with no leaks and test the water heater for proper operation.

Learning Activities

1. READ Meyerink, G., Appliance Service Handbook, pp. 404-411.

   (or) ____________________

2. OBSERVE the instructor demonstrate the installation of an electric water heater.

3. PRACTICE installing an electric water heater. Follow the procedure in Instruction Sheet I.

4. COMPLETE the check-out activity listed for this task assignment. You will be rated according to the intructor's final checklist.

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INSTRUCTION SHEET I

INSTALL AN ELECTRIC WATER HEATER

1. Select the location of the hot water heater.
2. Gather the necessary tools and equipment to install the appliance.
3. Unpack the hot water heater.
4. Install the unit, making all the proper connections.
5. Check the hot water heater for proper operation.
6. Clean and store all materials.

INSTRUCTOR'S FINAL CHECKLIST

INSTALL AN ELECTRIC WATER HEATER

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In installing an electric water heater the student performed the following:

	FULLY AC	NOT AC	NOT AP
1. Selected the proper location for hot water heater.	____	____	____
2. Gathered necessary tools.	____	____	____
3. Unpacked the hot water heater.	____	____	____
4. Installed the hot water heater.	____	____	____
5. Checked for proper operation.	____	____	____
6. Cleaned and stored all materials.	____	____	____

TASK ASSIGNMENT SHEET APR-054

Appliance Repairer

REPLACE ELECTRIC WATER HEATER HEATING ELEMENT

INTRODUCTION

Many times the useful service of an electric water heater may be extended by replacing the heating element if it is defective. In this task assignment, you will learn to replace the heating element in an electric water heater.

OBJECTIVE

The instructor will furnish an electric water heater, test instruments, tools, and a replacement heating element. You will remove and install a heating element in the water heater. You will be rated according to the instructor's final checklist.

CHECK-OUT ACTIVITY

Your instructor will provide an electric water heater, tools and equipment, and a replacement heating element. Install the replacement heating element in the water heater so that it operates to proper specifications with no leaks.

Learning Activities

1. READ Meyerink, G., Appliance Service Handbook, pp. 405-411.

   (or) ____

2. OBSERVE a demonstration by the instructor on replacing a water heater element.

3. PRACTICE detecting and replacing a defective heating element in an electric water heater. Follow the procedure in Instruction Sheet I.

4. CHECK YOUR KNOWLEDGE by answering on a separate sheet of paper the questions on Student Self-Check I.

5. COMPLETE the check-out activity listed for this task assignment. You will be evaluated according to the instructor's final checklist.

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INSTRUCTION SHEET I

REPLACE ELECTRIC WATER HEATER HEATING ELEMENT

1. Disconnect the power supply and remove the control panel.
2. Use the voltmeter in checking the following:
   a. Line one to the lower heating unit.
   b. Line two to the third screw on the double-throw thermostat.
   c. Line three to the first screw on the double-throw thermostat.
   d. Line four to the bottom screw on the upper heating unit.
   e. From the second screw on the top thermostat to the top screw on the upper heating unit.
3. Read test equipment properly.
4. Diagnose problem element of electric water heater.
5. Remove the defective heating element.
6. Install a new heating element to proper specifications.
7. Check water heater for proper operation.
8. Clean and store all materials in proper place.
9. Performed all activities in a safe manner.

Student Self-Check I

WATER HEATER ELEMENT TEST

Directions: Write the answers to the questions below on a separate sheet of paper.

A. Given paper and pencil, a sectional view of a water heater, the student will:

1. Describe the purpose of this appliance.

2. Describe the operation of this appliance.

3. Describe the type of wire used in water heater circuits.

4. Sketch a wiring diagram of this appliance.

5. Identify the parts of this appliance on the sectional view and explain their functions.

6. Name the tools used to repair water heater elements.

7. Name the most common malfunctions in the heating element of water heater.

The student will accomplish the preceding tasks accurately within 30 minutes.

INSTRUCTOR'S FINAL CHECKLIST

REPLACE ELECTRIC WATER HEATER HEATING ELEMENT

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In replacing a defective heating element in an electric water heater the student performed the following:

	FULLY AC	NOT AC	NOT AP
1. Disconnected the power supply before servicing the unit.			
2. Gathered the necessary tools and materials.			
3. Removed the defective element.			
4. Installed a new element to proper specifications.			
5. Checked water heater for proper operation.			
6. Cleaned and stored all materials in proper place.			
7. Performed all activities in a safe manner.			

Appliance Repairer

REPLACE DEFECTIVE WIRING ON A WATER HEATER

INTRODUCTION

Wiring in an electric water heater may require partial or complete replacement due to deterioration of insulation or breakage. In this task assignment, you will learn to replace wiring in an electric water heater.

OBJECTIVE

The instructor will provide a water heater, VOM, tools and new wiring. You will remove defective wiring and install new wiring in the water heater circuits. You will be rated according to the instructor's final checklist.

CHECK-OUT ACTIVITY

Your instructor will provide an electric water heater, new wiring, and the proper tools. You will correctly rewire the electric water heater wiring circuits to the manufacturer's specifications.

Learning Activities

1. READ Meyerink, G., Appliance Service Handbook, pp. 405-411.

   (or) ______________________________

2. OBSERVE the instructor demonstrate testing and replacing wiring on an electric water heater.

3. PRACTICE testing and replacing wiring on a water heater using the procedure in Instruction Sheet I.

4. CHECK YOUR KNOWLEDGE by answering on a separate sheet of paper, the questions from Student Self-Check I.

5. COMPLETE the check-out activity listed for this task assignment. You will be evaluated according to the instructor's final checklist.

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INSTRUCTION SHEET I

REPLACE DEFECTIVE WIRING ON A WATER HEATER

1. Disconnect the power supply and remove the control panel.
2. Use the voltmeter in checking.
   a. Line one to the lower heating unit.
   b. Line two to the third screw on the double-throw thermostat.
   c. Line three to the first screw on the double-throw thermostat.
   d. Line four to the bottom screw on the upper heating unit.
   e. From the second screw on the top thermostat to the top screw on the upper heating unit.
3. Correct any defects and replace the panel cover.

The student will accomplish the preceding tasks accurately and safely.

STUDENT SELF-CHECK I

---

1. Describe the purpose of this appliance.
2. Describe the operation of this appliance.
3. Describe the type of wire used in water heater circuits.
4. Sketch a wiring diagram of this appliance.
5. Name the tools used to repair water heater wiring.
6. Name the most common malfunctions in the wiring of water heaters.

The student will accomplish the preceding task accurately within 30 minutes.

INSTRUCTOR'S FINAL CHECKLIST

REPLACE DEFECTIVE WIRING ON A WATER HEATER

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In replacing wiring in a electric water heater the student performed the following:	FULLY AC	NOT AC	NOT AP
1. Disconnected the power before servicing the unit.	____	____	____
2. Gathered the necessary tools and materials.	____	____	____
3. Removed defective wiring on water heater.	____	____	____
4. Replaced new wiring on water heater.	____	____	____
5. Checked the water heater for proper operation.	____	____	____
6. Cleaned and stored all materials in proper place.	____	____	____

Appliance Repairer

REPLACE ELECTRIC WATER HEATER THERMOSTAT

INTRODUCTION

A thermostat controls the regulation and operation of a water heater. In this task assignment you will learn to remove a defective thermostat and install a replacement in an electric water heater.

OBJECTIVE

Given a water heater with a defective thermostat, tools, and equipment by the instructor, you will remove and replace a thermostat in an electric water heater. You will be rated according to the instructor's final checklist.

CHECK-OUT ACTIVITY

The instructor will provide an electric water heater, a replacement thermostat, proper equipment and tools. Install the replacement thermostat so that the water heater operates within the manufacturer's specifications.

Learning Activities

1. READ Mayerink, G., Appliance Service Handbook, pp. 405-411.

   (or) ______________________________

2. OBSERVE a demonstration by the instructor of replacing an electric water heater thermostat.
3. PRACTICE replacing a water heater thermostat. Follow the procedure in Instruction Sheet I.
4. CHECK YOUR KNOWLEDGE by answering on a separate sheet of paper the questions from Student Self-Check I.
5. COMPLETE the check-out activity listed for this task assignment. You will be evaluated according to the Instructor's Final Checklist.

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INSTRUCTION SHEET I

REPLACE ELECTRIC WATER HEATER THERMOSTAT

1. Disconnect the power supply.
2. Remove the control panel.
3. Remove the thermostat.
4. On double-throw thermostats, check terminals 1 and 2, if there is continuity, apply heat.
5. If the thermostat is working correctly, terminals 3 and 4 will have continuity.
6. Insert the thermostat and replace the cover.
7. Connect the power supply.

The student will accomplish the preceding tasks accurately and safely.

STUDENT SELF-CHECK I

A. Given (1) paper and pencil, (2) a sectional view of a water heater, the student will:

1. Describe the purpose of the thermostat
2. Describe the effect of these parts on the appliance
3. Describe why the parts were replaced
4. Sketch a wiring diagram of this appliance
5. Identify the parts of this appliance on the sectional view and explain their functions
6. Name the tools used to repair a water heater
7. Name the most common malfunctions in the wiring of water heaters.

The student will accomplish the preceding tasks accurately within 30 minutes.

INSTRUCTOR'S FINAL CHECKLIST

REPLACE ELECTRIC WATER HEATER THERMOSTAT

	FULLY AC	NOT AC	NOT AP
Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.			
In replacing an electric water heater thermostat the student performed the following:			
1. Disconnected the power supply.			
2. Removed the control panel.			
3. Removed the defective thermostat.			
4. Installed a new thermostat.			
5. Replaced the cover.			
6. Checked the water heater for proper operation.			
7. Cleaned and stored all material in proper place.			

Appliance Repairer

INSTALL AN AUTOMATIC DISHWASHER

INTRODUCTION

Correct installation of an appliance is important to ensuring its proper functioning and customer satisfaction with the appliance. In this task assignment, you will learn to install an automatic dishwasher.

OBJECTIVE

Given an automatic dishwasher and the necessary tools by the instructor, you will install the dishwasher so that it operates within the manufacturer's specifications. You will be rated according to the instructor's final checklist.

CHECK-OUT ACTIVITY

Your instructor will provide an automatic dishwasher and tools. You will install the dishwasher to the manufacturer's specifications.

Learning Activities

1. READ Meryerink, G., Appliance Service Handbook, pp. 42-44.

   (or) ____________________

2. OBSERVE the instructor demonstrate the installation of an automatic washer.

3. PRACTICE installing an automatic dishwasher. Follow the installation procedures in Instruction Sheet I.

4. COMPLETE the check-out activity listed for this task assignment. You will be evaluated according to the instructor's final checklist.

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INSTRUCTION SHEET I

INSTALL AN AUTOMATIC DISHWASHER

1. Install the drain line according to local plumbing code regulations.
2. Install the inlet pipe from the hot water supply.
3. Install the lead-in wire from the fuse panel.
4. Check the availability and pressure of hot water.
5. Level the machine.
6. Install the fuses and check for proper grounding.
7. Test for proper operation through an entire cycle.
8. Clean and store all materials in their proper places.

INSTRUCTOR'S FINAL CHECKLIST

INSTALL AN AUTOMATIC DISHWASHER

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

	FULLY AC	NOT AC	NOT AP
In installing an automatic dishwasher the student performed the following:			
1. Installed the drain line properly.	____	____	____
2. Installed the inlet pipe from hot water supply.	____	____	____
3. Installed the lead-in wire from the fuse panel.	____	____	____
4. Checked hot water and pressure.	____	____	____
5. Leveled machine, installed fuses.	____	____	____
6. Checked for proper grounding.	____	____	____
7. Tested for proper operation.	____	____	____
8. Cleaned and stored all materials.	____	____	____

Appliance Repairer

REPLACE SWITCHES ON AN AUTOMATIC DISHWASHER

INTRODUCTION

A defective or malfunctioning switch may be the cause of many service problems on an automatic dishwasher. In this task assignment, you will learn to replace switches on an automatic dishwasher.

OBJECTIVE

Given an automatic dishwasher, replacement switches, tools, and a service manual, you will replace defective switches as necessary to restore the dishwasher to proper operation. You will be rated according to the instructor's final checklist.

CHECK-OUT ACTIVITY

Your instructor will provide an automatic dishwasher, replacement switches, tools, and a service manual. You will replace switches to restore dishwasher operation.

Learning Activities

1. READ Whirlpool Corporation, Automatic Dishwasher, pp. 40-43., and Meyerink, G., Appliance Service Handbook, pp. 247-255.

   (or)____

2. OBSERVE the instructor demonstrate the replacement of the various types of switches used in an automatic dishwasher.
3. PRACTICE replacing the various switches on an automatic dishwasher.
4. COMPLETE the check-out activity listed for this task assignment. You will be rated according to the instructor's final checklist.

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INSTRUCTOR'S FINAL CHECKLIST

REPLACE SWITCHES ON AN AUTOMATIC DISHWASHER

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In replacing defective switches on an automatic dishwasher, the student performed the following:

	FULLY AC	NOT AC	NOT AP
1. Removed panels for access to switches.			
2. Diagnosed defective switch.			
3. Secured correct replacement switch.			
4. Disconnected wiring and removed old switch.			
5. Installed replacement and connected wiring.			
6. Checked switch for correct operation.			
7. Installed panels.			
8. Cleaned work area and stored tools.			

Appliance Repairer

REPLACE A DISHWASHER MOTOR AND PUMP ASSEMBLY

INTRODUCTION

This task assignment will aid you in learning to replace an automatic dishwasher motor and pump assembly.

OBJECTIVE

Given an automatic dishwasher, replacement motor and pump assembly, tools, and test instruments you will remove a defective motor and pump assembly and install a replacement. You will be rated according to the instructor's final checklist.

CHECK-OUT ACTIVITY

Your instructor will provide an automatic dishwasher replacement motor and pump assembly, tools, and test instruments. You will remove the defective motor and pump assembly and install a replacement.

Learning Activities

1. READ Whirlpool Corporation, "The Mechanics of Whirlpool Dishwasher," KD-1.,
   and
   ________________, Whirlpool Dishwasher, Chapter 3, pp. 18-25 and p. 46.

   (or)____

2. OBSERVE the instructor demonstrate the replacement of an automatic dishwasher motor and pump assembly.

3. PRACTICE replacing a dishwasher motor and pump assembly. Follow instructions in Instruction Sheet I.

4. COMPLETE the check-out activity listed for the task assignment. You will be rated according to the instructor's final checklist.

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INSTRUCTION SHEET I

REPLACE A DISHWASHER MOTOR AND PUMP ASSEMBLY

1. Disconnect power supply.
2. Gain access to the motor by removing the panel or tilting the washer.
3. Remove the fan blade, if it is connected to the motor shaft.
4. Disconnect the drain hose from the pump.
5. Remove the screws holding the motor-pump assembly to the bottom of the cabinet.
6. Remove the impeller from the pump, if it is secured to the motor shaft.
7. Remove the pump housing from the motor.
8. Remove the wiring from the motor, noting the proper connections, and install the new assembly.
9. Reconnect power supply.
10. Check washer for proper operation.

THE STUDENT WILL ACCOMPLISH THE PRECEDING TASKS ACCURATELY AND SAFELY.

INSTRUCTOR'S FINAL CHECKLIST

REPLACE A DISHWASHER MOTOR AND PUMP ASSEMBLY

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In replacing an automatic dishwasher motor and pump assembly the student performed the following:

		FULLY AC	NOT AC	NOT AP
1.	Disconnected power supply.			
2.	Removed the panel and tilted the washer.			
3.	Removed the fan blade.			
4.	Disconnected the drain hose from the pump.			
5.	Removed screws holding the motor-pump.			
6.	Removed the impeller, pump housing and wiring.			
7.	Installed the new motor and drain pump assembly.			
8.	Reconnect power supply.			
9.	Checked for proper operation.			

Appliance Repairer

REPLACE AUTOMATIC DISHWASHER TIMER

INTRODUCTION

The timer plays an important function in an electric dishwasher. The timer programs the other electrical components in such a manner to control the mechanical functions, water system, and various dispensing mechanisms of the dishwasher.

OBJECTIVE

Given an electric dishwasher, a replacement timer, proper tools, and a service manual from the instructor, you will install the timer to the manufacturer's specification. You will be evaluated according to the instructor's final checklist.

CHECK-OUT ACTIVITY

Your instructor will provide an electric dishwasher, a replacement timer, and proper tools. You will remove and replace a defective timer so that the dishwasher operates to the manufacturer's specifications.

Learning Activities

1. READ Whirlpool Corporation, Automatic Dishwashers, pages 35-38.

   (or) ______________________________

2. OBSERVE the instructor demonstrate replacing a defective timer on an automatic dishwasher.

3. PRACTICE replacing a timer on an automatic dishwasher using tools and equipment furnished by the instructor.

4. COMPLETE the check-out activity listed for this task assignment. You will be rated according to the instructor's final checklist.

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INSTRUCTOR'S FINAL CHECKLIST

REPLACE AUTOMATIC DISHWASHER TIMER

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In replacing a timer on an automatic dishwasher, the student performed the following:

	FULLY AC	NOT AC	NOT AP
1. Gathered necessary tools and materials.	____	____	____
2. Removed defective timer from dishwasher.	____	____	____
3. Installed correct replacement timer.	____	____	____
4. Tested timer for proper operation.	____	____	____
5. Cleaned work area and stored all materials.	____	____	____

Appliance Repairer

REPLACE AUTOMATIC DISHWASHER HEATING ELEMENT

INTRODUCTION

The heating element in an automatic dishwasher maintains water temperature and provides heat for the drying cycle. In this task assignment, you will replace a defective heating element.

OBJECTIVE

Given an automatic dishwasher, test instrument, proper tools, a replacement heating element, and a service manual, you will replace a defective heating element. You will be rated according to the instructor's final checklist.

CHECK-OUT ACTIVITY

The instructor will provide an automatic dishwasher, a replacement heating element, tools and equipment. You will remove a defective heating element and replace it with a new heating element to the manufacturer's specifications.

Learning Activities

1. READ Whirlpool Corporation, Automatic Dishwashers, page 34, and Meyerink, G., Appliance Service Handbook, pages 93-95.

   (or) ____________________

2. OBSERVE the instructor demonstrate replacing an automatic dishwasher heating element.
3. PRACTICE replacing a dishwasher heating element by following the procedure outlined in Instruction Sheet I.
4. COMPLETE the check-out activity listed for this task assignment. You will be rated according to the instructor's final checklist.

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INSTRUCTION SHEET I

REPLACE AN AUTOMATIC DISHWASHER HEATING ELEMENT

1. Disconnect dishwasher from electrical power supply.
2. Remove the loading door and racks from the dishwasher.
3. Remove the panel for access to the heater connections.
4. Disconnect the wires from the heater terminals.
5. Remove the heater from the mounting.
6. Install the correct replacement element.
7. Reassemble the unit.
8. Test the dishwasher for proper operation.
9. Clean the work area and store all equipment.

INSTRUCTOR'S FINAL CHECKLIST

REPLACE AUTOMATIC DISHWASHER HEATING ELEMENT

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In replacing an automatic dishwasher heating element the student performed the following:

	FULLY AC	NOT AC	NOT AP
1. Disconnected power supply.	____	____	____
2. Removed the loading door and racks.	____	____	____
3. Removed panel and disconnected wires to heater element.	____	____	____
4. Removed heater from mounting.	____	____	____
5. Installed replacement heater.	____	____	____
6. Reassembled dishwasher.	____	____	____
7. Tested dishwasher for proper operation.	____	____	____
8. Cleaned work area and stored all equipment.	____	____	____

TASK ASSIGNMENT SHEET APR-062

Appliance Repairer

CHECK DISHWASHER FOR PROPER OPERATION

INTRODUCTION

Some dishwashers have six operating cycles. Each of the cycles is an important part in the washing of dishes. In this task assignment, you will learn the different cycles of a dishwasher and how they operate.

OBJECTIVE

Given an automatic dishwasher by the instructor, you will distinguish the different cycles of the dishwasher, test the washer for proper operation by running the machinc through its cycles. You will be rated according to the instructor's final checklist.

CHECK-OUT ACTIVITY

The instructor will provide an automatic dishwasher and test equipment if needed. You will test each cycle of the dishwasher for proper operation, water temperature, and select proper detergent.

Learning Activities

1. READ Whirlpool Corporation, Automatic Dishwasher, pages 15 through 17.

   (or) ______________________________

2. OBSERVE your instructor demonstrate the proper functions of the cycles of the dishwasher.

3. VIEW the film "Automatic Dishwasher."

4. PRACTICE checking the cycles of an automatic dishwasher for correct operation.

5. COMPLETE the check-out activity listed for this task assignment. You will be rated according to the instructor's final checklist.

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INSTRUCTOR'S FINAL CHECKLIST

CHECK DISHWASHER FOR PROPER OPERATION

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In checking the operating cycles of a automatic dishwasher the student performed the following:

	FULLY AC	NOT AC	NOT AP
1. Checked all cycles for proper operation.	____	____	____
2. Checked water for proper operating temperature.	____	____	____
3. Selected proper detergent for use.	____	____	____

Appliance Repairer

UNDERSTAND AUTOMATIC CLOTHES WASHER WIRING DIAGRAMS

INTRODUCTION

The lines on a road map show which road to take to reach your destination. Because the wiring diagram provides very accurate operational details, it can be compared to a road map. The lines on a wiring diagram show how electric current travels in the electrical system of the appliance to make it function.

OBJECTIVE

Using materials provided by the instructor, you will study the wiring diagrams of an automatic clothes washer and diagnose problems in the electrical circuits. You will recognize symbols used in electrical diagrams quickly and accurately. Troubleshooting diagnosis should begin by visually inspecting and listening to machine operation.

CHECK-OUT ACTIVITY

Your instructor will provide an automatic clothes washer and wiring diagrams. You will interpret the wiring diagram and compare the wiring diagram with the wiring circuits. You will complete the unit test on wiring diagrams with a score of 85% or higher.

Learning Activities

1. READ Whirlpool Corporation, Understanding Automatic Washer, Chapter 8, pages 125-135.

   (or) ______________________________

2. OBSERVE the presentation by the instructor on wiring diagram symbols.
3. PRACTICE identifying the wiring diagram symbols given in Instruction Sheet I.
4. PRACTICE comparing and identifying a wiring diagram with the electrical circuits in an automatic clothes washer.
5. COMPLETE the check-out activity listed for this task assignment. You will be rated according to the instructor's final checklist.

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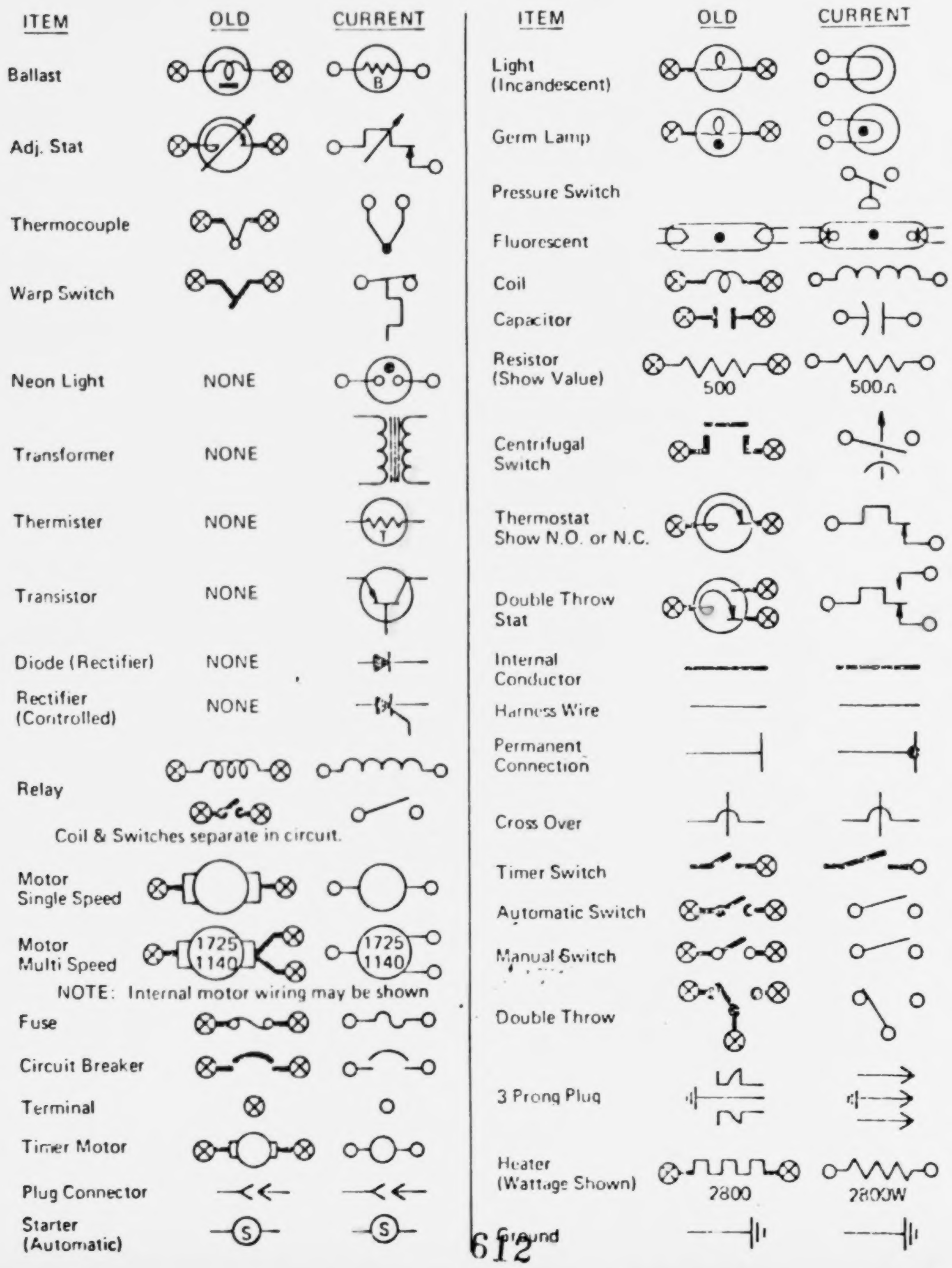
INSTRUCTION SHEET 1

UNDERSTAND AUTOMATIC WASHER WIRING DIAGRAMS

WIRING DIAGRAM SYMBOLS


ITEM
OLD
CURRENT
Ballast
B
Adj. Stat
Thermocouple
Warp Switch
Neon Light
NONE
Transformer
NONE
Thermister
NONE
T
Transistor
NONE
Diode (Rectifier)
NONE
Rectifier (Controlled)
NONE
Relay
Coil & Switches separate in circuit.
Motor Single Speed
Motor Multi Speed
1725
1140
1725
1140
NOTE: Internal motor wiring may be shown
Fuse
Circuit Breaker
Terminal
Timer Motor
Plug Connector
Starter (Automatic)
S
S
ITEM
OLD
CURRENT
Light (Incandescent)
Germ Lamp
Pressure Switch
Fluorescent
Coil
Capacitor
Resistor (Show Value)
500
500Ω
Centrifugal Switch
Thermostat Show N.O. or N.C.
Double Throw Stat
Internal Conductor
Harness Wire
Permanent Connection
Cross Over
Timer Switch
Automatic Switch
Manual Switch
Double Throw
3 Prong Plug
Heater (Wattage Shown)
2800
2800W
Ground

INSTRUCTOR'S FINAL CHECKLIST

UNDERSTAND AUTOMATIC WASHER WIRING DIAGRAMS

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In learning automatic washer wiring diagrams and electric circuits the student performed the following:

	FULLY AC	NOT AC	NOT AP
1. Read the material on wiring diagrams.			
2. Identified wiring diagrams symbols correctly.			
3. Checked wiring diagrams against electrical circuits.			
4. Completed unit test with a score of 85% or higher.			

Appliance Repairer

UNDERSTAND FUNDAMENTALS OF MICROWAVE OVENS

INTRODUCTION

This task assignment explains how foods are cooked with microwave energy and the differences between microwave cooking and conventional cooking. Characteristics and effects of microwave energy will be covered. All components in the microwave oven will be covered individually and in relation to the total system. You will be aware of the safety features of microwave ovens.

OBJECTIVE

Given a microwave oven and the necessary tools and equipment by the instructor, you will expose the components of the unit and identify the parts by name and function. You will identify and give the purpose of the safety features in the unit.

CHECK-OUT ACTIVITY

Given an exploded view of a microwave oven, you will identify in writing the component parts of the unit. You will identify and describe the safety feature of the microwave. A score of 85% or higher is required to complete this check-out activity.

Learning Activities

1. READ Meyerink, G., Appliance Service Handbook, pages 342-351.

   (or) ______________________________

2. OBSERVE a presentation by your instructor of the slide program "The Fundamentals of Whirlpool Microwave Ovens."

3. PRACTICE identifying the components and safety features on a microwave oven provided in the shop.

4. CHECK YOUR KNOWLEDGE by using the recall booklet by Whirlpool, "The Fundamentals of Whirlpool Microwave Ovens."

5. COMPLETE the check-out activity for this task assignment. You will be rated according to the instructor's final checklist.

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INSTRUCTOR'S FINAL CHECKLIST

UNDERSTAND FUNDAMENTALS OF MICROWAVE OVENS

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In learning about the fundamental of microwave ovens, the student completed the following:

	FULLY AC	NOT AC	NOT AP
1. Read assigned material on microwave ovens.	____	____	____
2. Observed the slide presentation on microwave ovens.	____	____	____
3. Identified component parts and safety features from an exploded view of a microwave oven.	____	____	____
4. Answered the questions in the recall booklet with a score of 85% or higher.	____	____	____

Appliance Repairer

INSTALL A MICRCOWAVE OVEN

INTRODUCTION

The microwave or electronic oven is one of the most popular of the convenience appliances. It is one of the easiest to install and operate of the kitchen appliance.

OBJECTIVE

Given a microwave oven by the instructor, you will demonstrate your knowledge of the correct installation procedure. You will be rated according to the instructor's final checklist.

CHECK-OUT ACTIVITY

You will install a microwave oven. Check the operation of the oven after installation and explain the various functions of the oven.

Learning Activities

1. READ Instruction Sheet I, "Installation of a Microwave Oven."

   (or) ______________________________

2. OBSERVE your instructor demonstrate the proper procedures to install a microwave oven.

3. PRACTICE installing a microwave oven using the procedure in Instruction Sheet I.

4. COMPLETE the check-out activity listed for this task assignment. You will be rated according to the instructor's final checklist.

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INSTRUCTION SHEET I

INSTALLATION OF A MICROWAVE OVEN

1. Remove all material from inside the oven.

2. Put the microwave oven on the counter, cart, table, etc. where you will be using it. Allow 2 inches of space between the back of the oven and the wall for proper ventilation.

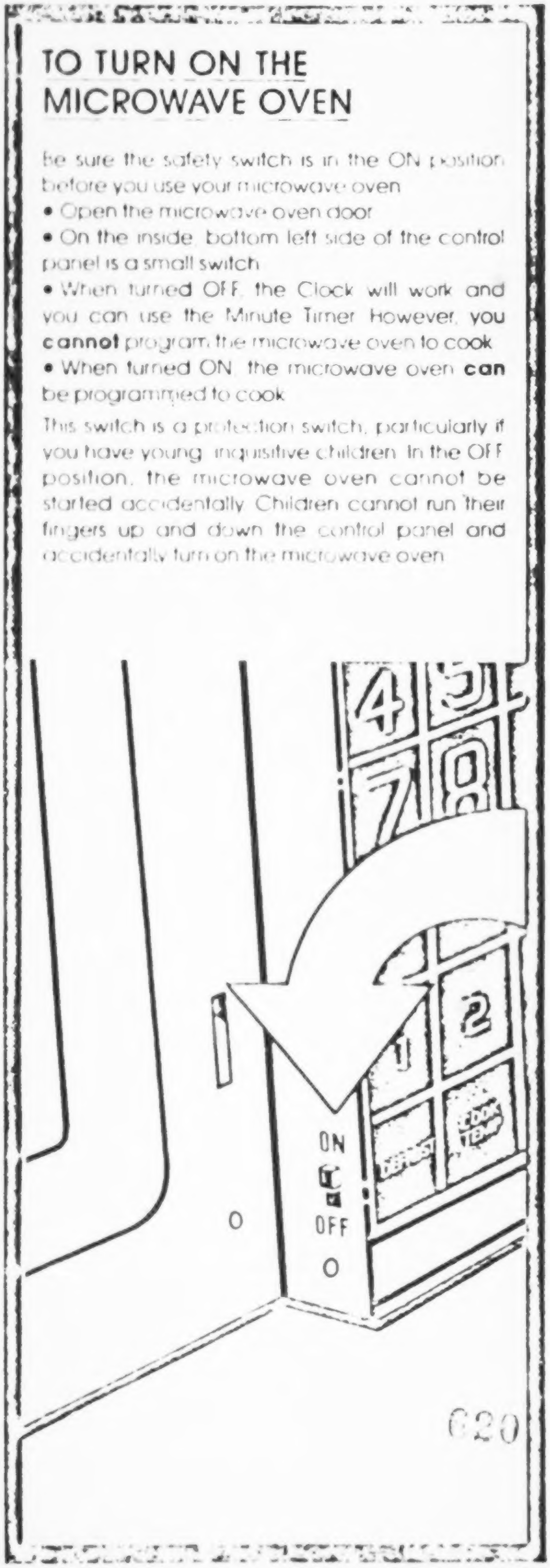
   This microwave oven may be installed as a wall insert appliance using the RCK 700 Build-In Kit.

   The microwave oven may be installed, with the kit above Whirlpool RDE and REE series single ovens and Hardwick 7200 series gas single ovens in accordance with the Manufacturer's Installation Instructions.

3. Be sure to choose a place near a 3-prong grounded type wall receptacle. For your personal safety, this appliance must be grounded. This appliance is equipped with a power supply cord having a 3-prong grounding plug. To minimize possible shock hazard, it must be plugged into a mating 3-prong grounding type wall receptacle, grounded in accordance with the National Electrical Code and local codes and oridances. If a mating wall receptacle is not available, it is the personal responsiblity and obligation of the customer to have a properly grounded 3-prong wall receptacle installed by a qualified electrician. DO NOT CUT THE ROUND GROUNDING PRONG FROM THIS PLUG.

4. Plug the unit into a 120 volt, 60 Hz., A.C. only household outlet. The microwave oven should be on a separate 15 ampere circuit. No other major household appliance should be on the same circuit. DO NOT USE AN EXTENSION CORD. The microwave oven will use about 17000 watts when it is operating.

INSTRUCTION SHEET I (page 2)



TO TURN ON THE MICROWAVE OVEN

Be sure the safety switch is in the ON position before you use your microwave oven

- Open the microwave oven door
- On the inside, bottom left side of the control panel is a small switch
- When turned OFF, the Clock will work and you can use the Minute Timer. However, you **cannot** program the microwave oven to cook
- When turned ON, the microwave oven **can** be programmed to cook

This switch is a protection switch, particularly if you have young, inquisitive children. In the OFF position, the microwave oven cannot be started accidentally. Children cannot run their fingers up and down the control panel and accidentally turn on the microwave oven

INSTRUCTOR'S FINAL CHECKLIST

INSTALL A MICROWAVE OVEN

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In installing a microwave oven the student performed the following:

	FULLY AC	NOT AC	NOT AP
1. Removed all materials from inside the oven.			
2. Placed the oven with proper ventilation space.			
3. Connected appliance to 120 volt, 60 Hz, A.C. power supply with a grounded 3-prong receptacle.			
4. Did not use an extension cord.			
5. Cleaned work area and stored equipment.			

Appliance Repairer

DIAGNOSE AND REPAIR MICROWAVE OVEN

INTRODUCTION

Each microwave oven will vary from others in some detail of operation, but, in general, they all follow the same sequence. By understanding the fundamentals of microwave ovens, you will be able to diagnose and repair any electronic oven.

OBJECTIVE

Using materials provided by the instructor, you will diagnose and repair problems common to microwave ovens. You will be evaluated according to the instructor's final checklist.

CHECK-OUT ACTIVITY

Your instructor will provide you with a microwave oven, wiring diagram, proper tools, and replacement parts. You will diagnose and repair problems presented by the instructor.

Learning Activities

1. READ Myerink, Appliance Service Handbook, pp. 342-351.

   (or) ______________________________

2. OBSERVE Instructor's presentation of procedures for microwave oven troubleshooting.

3. PRACTICE diagnosing and repairing a microwave oven using tools and equipment furnished by instructor.

4. COMPLETE the check-out activity listed for this task assignment. You will be rated according to the Instructor's Final Checklist.

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INSTRUCTOR'S FINAL CHECKLIST

DIAGNOSE AND REPAIR MICROWAVE OVEN

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In diagnosing and repairing a microwave oven, the student performed the following:

	FULLY AC	NOT AC	NOT AP
1. Programmed and operated the oven through all operating functions.	_____	_____	_____
2. Followed safety procedures in accessing components of the oven.	_____	_____	_____
3. Identified reasons for malfunction.	_____	_____	_____
4. Removed and replaced defective component.	_____	_____	_____
5. Tested oven operation.	_____	_____	_____
6. Cleaned work area and stored tools.	_____	_____	_____

Appliance Repairer

DIAGNOSE AND REPAIR MARK SERIES MICROWAVE OVENS

INTRODUCTION

This task assignment will help you in diagnosing and repairing microwave ovens with the more recent solid state control systems. Each of the circuit boards are serviceable as is the reed relay and may be serviced from the front or right side of the unit.

OBJECTIVE

Given a microwave oven an the necessary tools by your instructor, you will check the operation of the oven and diagnose any malfunctions. The repaired unit will function to the manufacturer's specifications. You will be rated according to the instructor's final checklist.

CHECK-OUT ACTIVITY

Given a microwave oven and the necessary tools and equipment, you will check the unit and determine if all functions are operating properly. If malfunctions are found, they are to be repaired.

Learning Activities

1. READ Whirlpool Corporation, "Mastering The Mark Series Microwave Oven," pages 20-31.

   (or) ____________________

2. OBSERVE a presentation by the instructor of the filmstrip "Mastering the Mark Series Microwave Oven."
3. READ recall booklet "Mastering the Mark Series Microwave Oven," page 1-17.
4. PRACTICE diagnosing and repairing a microwave oven using tools and equipment furnished by the instructor.
5. COMPLETE the check-out activity listed for this task assignment. You will be rated according to the instructor's final checklist.

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INSTRUCTOR'S FINAL CHECKLIST

DIAGNOSE AND REPAIR MARK SERIES MICROWAVE OVENS

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In diagnosing and repairing a Mark Series microwave oven, the student performed the following:

	FULLY AC	NOT AC	NOT AP
1. Programmed and operated oven through all operating functions.	____	____	____
2. Followed safety procedures in accessing components of the oven.	____	____	____
3. Identified circuit board(s) or switch responsible for malfunction.	____	____	____
4. Removed and replaced defective component.	____	____	____
5. Tested oven operation.	____	____	____
6. Cleaned work area and stored tools.	____	____	____

Appliance Repairer

REPLACE MAGNETRON TUBE

INTRODUCTION

The magnetron tube in a microwave oven is the heart of the appliance. It generates the high power microwave that provides the heat. Most magnetron tubes are highly reliable, however, occasionally they must be replaced. The replacement procedure can be dangerous because of the high voltages involved. Extreme caution must be exercised when replacing the tube.

OBJECTIVE

Using materials provided by the instructor, you will replace a microwave magnetron tube. You will be evaluated according to the instructor's final checklist.

CHECK-OUT ACTIVITY

Your instructor will provide you with a microwave oven, a replacement magnetron tube, and the proper tools. You will install the magnetron tube and insure that the microwave oven operates at manufacturer's specifications.

Learning Activities

1. READ Manufacturer's Repair Manual.
2. OBSERVE the instructor demonstrate how to correctly replace a microwave magnetron tube.
3. PRACTICE replacing a microwave magnetron tube.
4. COMPLETE the check-out activity listed for this task assignment. You will be rated accoridng to the instructor's final checklist.

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INSTRUCTION SHEET I

REPLACE MAGNETRON TUBE

1. Disconnect power supply.
2. Remove cabinet.
3. Drain charge from capacitor.
4. Remove magnetron tube and install replacement.
5. Reassemble microwave oven and reconnect power supply.
6. Clean up area and store tools and materials.

INSTRUCTOR'S FINAL CHECKLIST

REPLACE MAGNETRON TUBE

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In replacing the magnetron tube in a microwave oven, the student performed the following:

	FULLY AC	NOT AC	NOT AP
1. Disconnected power supply.			
2. Removed the cabinet.			
3. Drained the capacitor.			
4. Removed and replaced the magnetron tube.			
5. Reassembled microwave oven.			
6. Cleaned area and stored tools.			

Appliance Repairer

INSTALL A WINDOW MOUNT AIR CONDITIONER

INTRODUCTION

This task assignment will help you in learning to install a window mount air conditioner.

OBJECTIVE

Given a window mount air conditioner, tools, and equipment by the instructor, you will install the air conditioner to the manufacturer's specifications. Your performance will be rated according to the instructor's final checklist.

CHECK-OUT ACTIVITY

Provided a window air conditioner, an installation kit, and the tools needed, install an air conditioning unit so that the adjusting panels are straight, no gaps show between the unit and the frame, and the unit drains properly.

Learning Activities

1. READ Meyerink, G., Appliance Service Handbook, pages 63-66.

   (or) ____________________

2. OBSERVE your instructor demonstrate installing a window mount air conditioner.

3. CHECK YOUR KNOWLEDGE by answering on a separate sheet of paper, question 1 through 7 on page 64 in Appliance Service Handbook.

4. PRACTICE installing an air conditioner following the procedure outlined in Instruction Sheet I.

5. COMPLETE the check-out activity listed for this task assignment. You will be rated according to the instructor's final checklist.

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INSTRUCTION SHEET I

INSTALL A WINDOW MOUNT AIR CONDITIONER

1. Read the manufacturer's installation instructions.
2. Select window to install unit.
3. Measure window and air conditioner for fit.
4. Remove shipping bolts from A/C compressor.
5. Insert air conditioner case in window.
6. Lower window and install window lock.
7. Install external brace, adjust to fit.
8. Trim and adjust side panels to fit window.
9. Seal gaps and openings with sealing compound.
10. Install air conditioner into case.
11. Install front panel on air conditoner.
12. Connect to grounded power source.
13. Perform operational test.
14. Clean work area and store materials.

INSTRUCTOR'S FINAL CHECKLIST

INSTALL A WINDOW MOUNT AIR CONDITIONER

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In installing a window mount air conditioner, the student performed the following:

	FULLY AC	NOT AC	NOT AP
1. Measured window and air conditioner for fit.	____	____	____
2. Removed shipping bolts from compressor.	____	____	____
3. Mounted air conditioner case in window and installed necessary braces.	____	____	____
4. Installed air conditioner in case.	____	____	____
5. Performed operational check.	____	____	____
6. Cleaned work area and stored materials.	____	____	____

Appliance Repairer

INSTALL RANGE HOOD

INTRODUCTION

Range hoods are necessary to vent steam and cooking odors either through a filter or to the outside. This task assignment will provide you with necessary skills to enable you to install a range hood.

OBJECTIVE

Given a range hood, proper tools, and manufacturer's installation instructions, you will install the range hood.

CHECK-OUT ACTIVITY

Your instructor will provide a range hood, manufacturer's installation instructions, and the proper tools. You will install the range hood so that it operates to manufacturer's specifications.

Learning Activities

1. READ Manufacturer's installation instructions.
2. OBSERVE your instructor demonstrate how to install a range hood.
3. PRACTICE installing a range hood.
4. COMPLETE the check-out activity for this task assignment. You will be rated according to the instructor's final checklist.

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INSTRUCTION SHEET I

INSTALL RANGE HOOD

1. Mount range hood above range.
2. Make electrical connections.
3. Check for proper operation.
4. Clean up work area and store tools.

INSTRUCTOR'S FINAL CHECKLIST

INSTALL RANGE HOOD

Performance Levels: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any Learning Activities must be repeated.

In installing a range hood, the student performed the following:

	FULLY AC	NOT AC	NOT AP
1. Mounted range hood above the range.			
2. Connected electrical power supply.			
3. Checked for proper operation.			
4. Cleaned work area and stored tools.			